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SPECIAL REPORT 164

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SPECIAL REPORT 164

MINERAL LAND CLASSIFICATION OF NEVADA COUNTY, CALIFORNIA

By

Ralph Loyd and John Clinkenbeard

1990

CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
1416 NINTH STREET, ROOM 1341
Sacramento, California 95814

PREFACE

The Surface Mining and Reclamation Act of 1975 (SMARA) was enacted to promote the conservation of the state's mineral resources and to ensure adequate reclamation of mined lands. Among other provisions, SMARA requires the State Geologist to classify land in California for mineral resource potential. Presently, mineral land classification studies are being conducted in several areas of the state on a county basis.

Upon completion of each study, the State Geologist submits the mineral land classification reports to the State Mining and Geology Board which transmits the information to appropriate local governments, that maintain jurisdictional authority in mining, reclamation, and related land-use activities. Local governments are required to incorporate the reports and maps into their general plans and consider the information when making land-use decisions.

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EXECUTIVE SUMMARY

California's Surface Mining and Reclamation Act of 1975 (SMARA) requires the State Geologist to classify land according to the presence or absence of significant mineral deposits. The classification is carried out without regard to existing land use. The primary objective of mineral land classification is to ensure that the mineral potential of land is recognized and considered in the land-use planning process.

This report covers all minerals, including metallic ores, industrial minerals, and construction aggregate resources for all of Nevada County. A total of 34 separate areas covering a combined 99 square miles within the county (approximately 10 percent of Nevada County) are classified as containing, or are likely to contain, significant mineral deposits. Such areas are identified by the mineral land classification category of Mineral Resource Zone-2 (MRZ-2) and are displayed in composite form on Plates 2a, 2b, and 2c (see map pocket). Descriptions of these areas are presented in Parts III and IV of this report.

Major findings of this study relative to metallic and industrial mineral resources are:

- Fifteen areas covering about 67 square miles of land are classified as containing significant precious and base metal resources. These deposits, which were formed through hydrothermal processes, include three massive sulfide deposits enriched in copper and zinc, two disseminated sulfide deposits enriched in gold, and 11 cavity-filling quartz-vein systems enriched in gold.

- Eight areas covering about 22 square miles are classified as containing significant placer gold resources. These include the Black Swan mine (Mooney Flat area), parts of San Juan Ridge, the French Corral-Birchville area, the Sailor Flat/Blue Tent area, the Quaker Hill-Red Dog/You Bet area, Relief Hill, Omega Diggings, and parts of Lowell Hill. The placer deposits of Nevada County also contain significant amounts of high-grade quartz, which is a source of silicon used in the manufacture of products such as computer chips, lubricants, and sealants.

- Two localities, the Upper Spanish mine and the Democrat mine (each covering about 0.1 square mile), are classified as containing significant inferred resources of barite. Although previously mined, remaining resources at these localities could represent economic deposits in the foreseeable future.

Major findings of this study relative to construction aggregate resources are:

- Twenty-eight areas covering approximately 23.9 square miles of Nevada County have been classified MRZ-2 for construction aggregate resources. This represents approximately 2.4 percent of the area of the county.

- Of the areas classified MRZ-2 for construction aggregate, approximately 19.5 square miles have been identified as Aggregate Resource Areas (ARA). An Aggregate Resource Area is an area that has been classified MRZ-2a or MRZ-2b for construction aggregate by the State Geologist and is deemed to be available for mining based upon criteria for compatibility provided by the State Mining and Geology Board. This represents approximately 2 percent of the county.

- Six operators (six deposits) are currently permitted for aggregate mining within Nevada County and have been identified as Immediately Significant.

ARA-6a	(Desert Gold, Inc. / N. C. Gravel)
ARA-9a	(North Star Rock Products, Inc.)
ARA-13	(Hansen Brothers Enterprises, Inc.)
ARA-20a	(R. J. Miles Company)
ARA-27a	(Teichert Aggregates)
ARA-30a	(Sha-Neva, Inc.)

  A seventh aggregate mining operation (two deposits) on the border of Nevada and Placer counties is also identified as Immediately Significant.

ARA-18	(Joe Chevreaux Company)
ARA-19	(Joe Chevreaux Company)

  These eight deposits total approximately 1.3 square miles or 0.13 percent of Nevada County.

- Thirteen areas have been identified as Highly Significant. These areas total approximately 10 square miles or 1 percent of Nevada County. Three of these deposits are identified as Highly Significant due to the large amount of material present. The remaining ten Highly Significant areas are identified as Highly Significant due to proximity to currently permitted aggregate mining operations.

- Eighteen areas have been identified as Significant. These areas total approximately 8.1 square miles or 0.8 percent of Nevada County.

Major findings of this study relative to the life expectancy of construction aggregate reserves in Nevada County are:

- The population in Nevada County is unevenly distributed with approximately 89 percent of the population located in the western part of the county and 11 percent in the eastern part of the county. The population in Nevada County is projected to more than double by the year 2020 (Nevada County, 1987).

- Due to the uneven distribution of the population of Nevada County and the cost of transporting aggregate, two separate aggregate markets exist - one in the west and one in the east.

- Nevada County is a net importer of construction aggregate and imports 20 percent to 30 percent more aggregate than is produced within the county. Aggregate is imported into the western part of the county from Yuba and Placer counties and into the eastern part of the county from the state of Nevada.

- There are currently six permitted aggregate mining operations within Nevada County with combined reserves of 28,560,000 tons. A seventh aggregate mining operation on the border of Nevada and Placer counties reports its production in Placer County and is considered to be in Placer County for the purposes of this report. More than one-half of the reserves are located in the eastern part of the county and less than one-half in the western part of the county.

- If the population of Nevada County increases as projected, the rate of aggregate production within the county, as well as the amount of aggregate imported into the county, can be expected to increase to meet the increased demands of the growing population.

- The currently permitted reserves of construction aggregate in western Nevada County are likely to be depleted by the year 2004, 14 years from the time of this study. The expected longevity of these reserves is based on the assumption that mining will continue to be permitted until the reserves are depleted, and does not accommodate aggregate replenishment at instream mine sites. Replenishment levels are currently unknown and cannot be determined without data collection, which is beyond the scope of this study.

- The currently permitted reserves of construction aggregate in eastern Nevada County are likely to be depleted by the year 2021, 31 years from the time of this study. The expected longevity of these reserves is based on the assumption that mining will continue to be permitted until the reserves are depleted.

INTRODUCTION

BACKGROUND

Local, state, and federal agencies are faced with difficult land-use decisions as competition for land for a variety of purposes increases. Since the availability of mineral resources is vital to our society, it is essential that mineral potential of land be considered in the land-use planning process. The California Surface Mining and Reclamation Act of 1975 requires the State Geologist to classify land, without regard to land use, according the presence or absence of significant mineral deposits. These studies are carried out under guidelines adopted by the State Mining and Geology Board (1983). As they are completed, the State Mining and Geology Board transmits the mineral land classification reports to appropriate lead agencies that are required to incorporate the information in their general plans and to use it in their land-use planning process.

SCOPE

Unlike earlier studies conducted by the Division of Mines and Geology that emphasized the reporting of mining information within the state, mineral land classification studies address the overall mineral potential of land through the identification of local and regional geologic factors that control or influence the formation of mineral deposits. Although mines and prospects are viewed as important sample points for accumulating geologic data on the nature and distribution of deposits within a mineralized area, information regarding the extent of workings, years of activity, total production, current status, etc. is not normally presented. This type of information may be obtained from the selected references given for mines and prospects plotted on the mineral land classification maps (Plates 2-7) and listed in Appendix A.

FIELDWORK AND RESEARCH

The Mineral Land Classification study of Nevada County was conducted intermittently over a three-year period between October 1987 and October 1990. Metallic and industrial mineral deposits were studied during the first two-year period by R.C. Loyd and construction aggregate deposits were evaluated during the last year by J.P. Clinkenbeard.

The mineral resource evaluation of Nevada County involved research of geologic and mining-related literature, compilation of geologic maps, and plotting of reported mines and prospects using publications and mine data of the Division of Mines and Geology, U.S. Geological Survey, U.S. Bureau of Mines and the

Bureau of Land Management. It also included fieldwork which involved site investigations of many of the known mines and mineral prospects located in the county (Appendix A), limited sampling of rocks for chemical analyses, geophysical surveys, and some geologic mapping. The research, field, and analytical data were integrated and evaluated to classify land in Nevada County according to guidelines adopted by the State Mining and Geology Board (1983).

GEOGRAPHIC SETTING

Nevada County is located in northern California and encompasses 992 square miles. It measures about 80 miles long and ranges from 9 to 20 miles wide, spanning the entire width of the northerly trending Sierra Nevada and into the western margin of the Basin and Range province (Figure 1). Elevations range from about 400 feet in the western foothill region to over 9,000 feet on the summit peaks of Mt. Lola, Castle Peak, and Basin Peak.

The Middle Fork of the Yuba River, which divides Nevada County from Sierra and Yuba counties on the north, drains the northern part of the county. The South Fork of the Yuba River and its major tributary, Deer Creek, drain the central part of the county. The Bear River, which in part divides Nevada and Placer counties, drains the southern part of the county along with its major tributaries, Greenhorn, Steephollow, and Wolf creeks.

Much of the county is rural, with most of the population concentrated in the vicinity of Grass Valley, Nevada City, Lake Wildwood Estates, Penn Valley, Rough and Ready, Lake of the Pines, and Alta Sierra. However, numerous low- to medium-density residential areas occur along or near county and state roads that traverse the western half of the county.

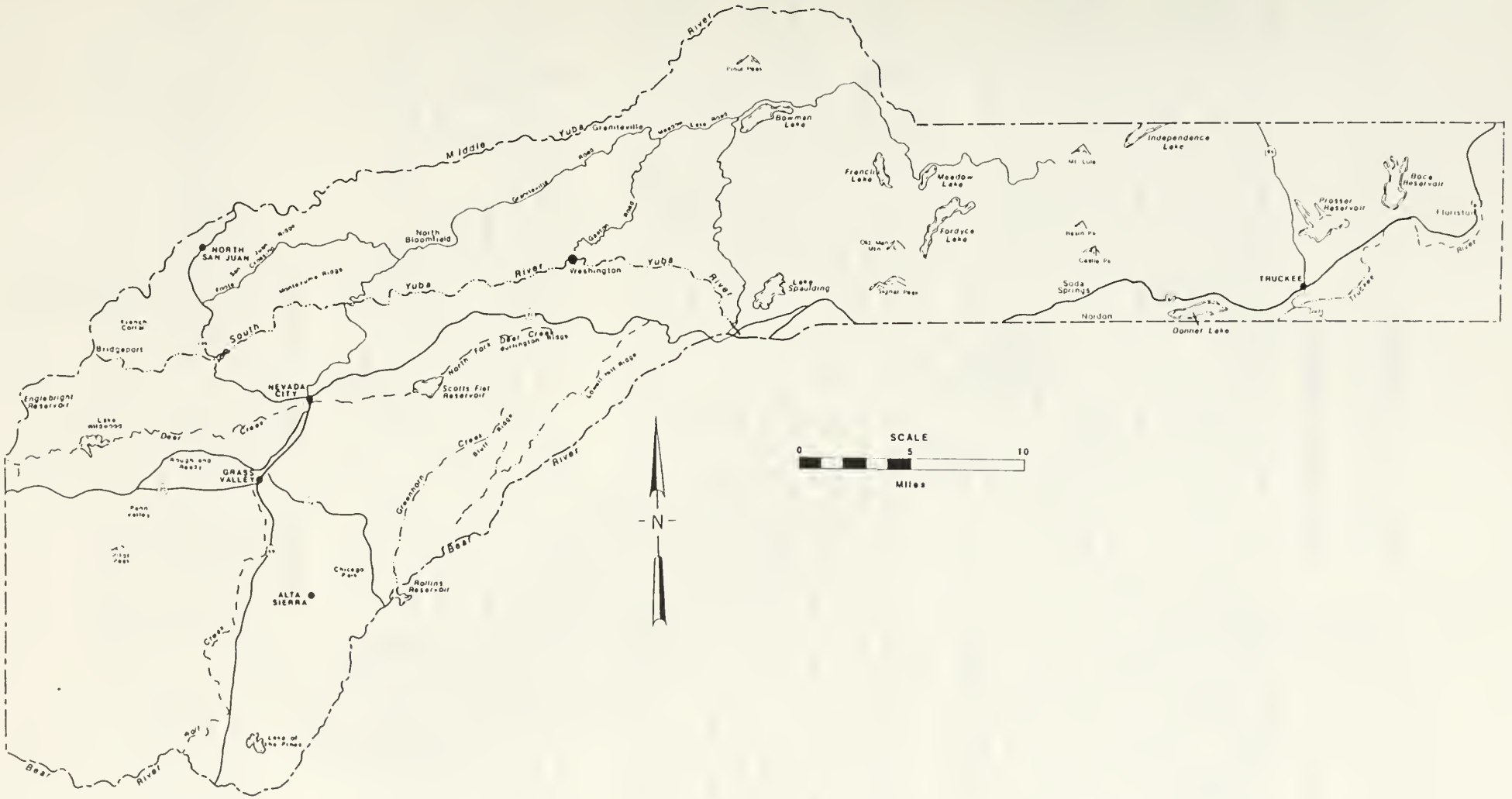


Figure 1. Geographic map of Nevada County.

PART I - GEOLOGY

REGIONAL GEOLOGY

The Sierra Nevada is a west-tilting, uplifted block of the earth's crust measuring over 400 hundred miles long by 50-80 miles wide. Most of the rocks which are exposed in the southern half of the Sierra Nevada and crop out along the crest of the northern half of the range are granitic rocks of the Mesozoic Sierra Nevada batholith. A northerly-trending belt of highly deformed, but weakly metamorphosed, volcanic and sedimentary rocks of Paleozoic and Mesozoic ages lies along the western slope between Lake Almanor and Mariposa. Tertiary volcanic rocks of the Basin and Range province are exposed over large areas east of the Sierra Nevada crest, while Cretaceous, Tertiary and Quaternary sediments of California's Central Valley overlap the Sierra Nevada bedrock on the west side (Figure 2).

There is general agreement among geologists that: (1) convergent plate tectonism governed the early Paleozoic to Late Jurassic development of metamorphic rock assemblages that are exposed along the western slope of the Sierra; (2) the emplacement of the Mesozoic Sierra Nevada batholith, largely during the interval of about 120-80 million years before present, was the result of convergent plate tectonism that involved rocks now exposed in the Coast Range; and (3) volcanic and volcanic-derived sedimentary rocks of the Basin and Range province developed as a consequence of right lateral and extensional plate tectonism during Cenozoic time. Uplift and erosion of the Sierra Nevada began sometime in the last five million years by normal faulting along the east scarp of the range.

Bateman and Wahrhaftig (1966) offer an excellent introductory geologic overview of the Sierra Nevada province. More recent discussions on the geology and geologic history of the northern Sierra Nevada and adjacent provinces are presented in Clark and Huber, (1975), Clark (1976), Stewart and others (1977), Howell and McDougall (1978), Hanna (1980), Ernst (1981), Hietanen (1981), Saleeby (1982), Harwood (1983), Latham (1985), Hanna and Moores (1986), Ernst (1988), Day and others (1988), Bateman (1988), and Edelman and others (1989).

GEOLOGY OF NEVADA COUNTY

Nevada County includes within its boundaries Paleozoic and Mesozoic metamorphic rocks, Paleozoic and Mesozoic plutonic rocks that intrude the metamorphic rocks, and Cenozoic volcanic and sedimentary rocks that locally overly both the metamorphic and plutonic rocks (Figure 3).

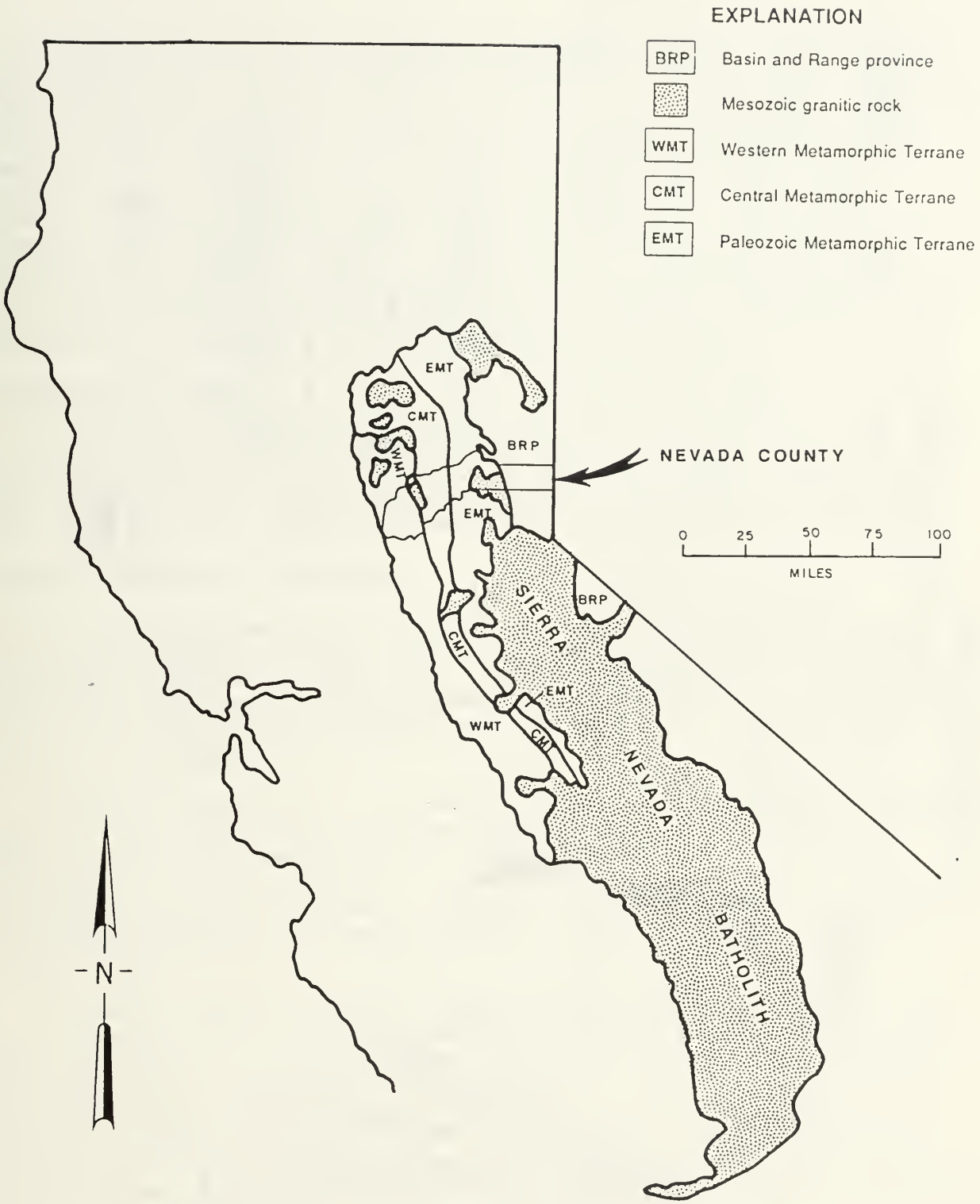
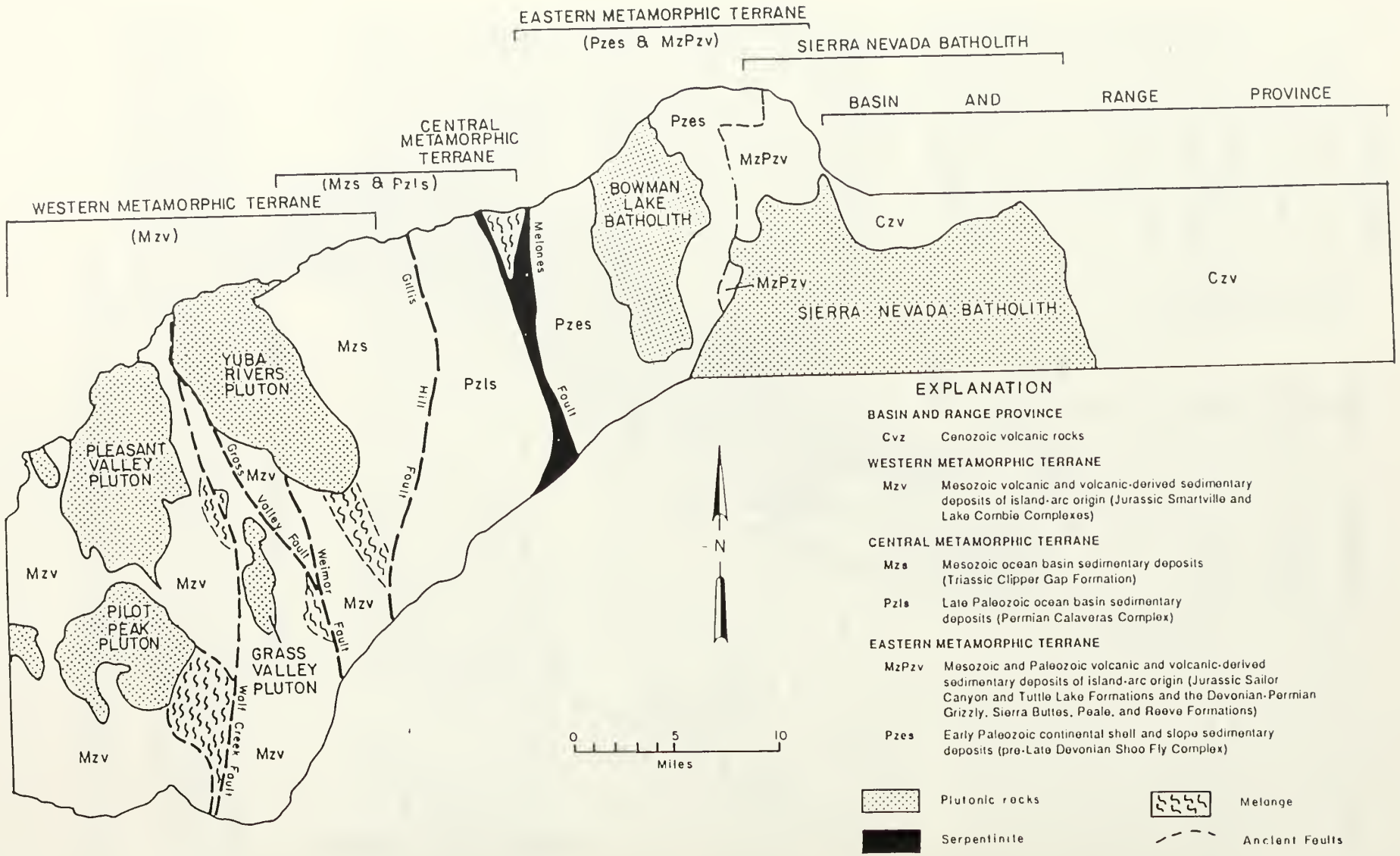


Figure 2. Geologic terranes of the Sierra Nevada province.



3. Geologic terranes of Nevada County.

Geologic mapping covering Nevada County was first published around the turn of the century by Lindgren (1896a; 1896b; 1900) and Lindgren and Turner (1895) at a scale of 1:125,000. More detailed mapping (scale 1:62,500 and 1:24,000) in different areas of the county has been accomplished by Southern Pacific Land Company (1959), Birkeland (1961; 1963), Kimball (1967), Yeend (1974), Varga (1980), Springer (1981), Bobbitt (1982), Kato (1982), Tuminas (1983), Hacker (1984), Kilbreath and others (1984), Schweickert (1984), Xenophontos (1984), Beard (1985), Latham (1985), Schweickert and Hanson (in preparation), and Schweickert and others (in preparation). A compilation of their mapping, with minor modifications resulting from this study, is presented on Plates 1a, 1b, and 1c.

METAMORPHIC ROCKS

Metamorphic rocks exposed in Nevada County can be divided on the bases of age and lithology into three northerly-trending, fault-bounded rock belts referred to in this report as the Eastern, Central, and Western metamorphic terranes (Figure 3).

EASTERN METAMORPHIC TERRANE:

The Eastern metamorphic terrane is bounded on the west by the northern Melones fault and on the east by the Sierra Nevada batholith (Figure 3; Plate 1b). Mapped bedrock units comprising the Eastern metamorphic terrane within Nevada County include the Shoo Fly Complex and the Grizzly, Sierra Buttes, Peale, Reeve, Sailor Canyon, and Tuttle Lake Formations.

Shoo Fly Complex: The Shoo Fly Complex of pre-Late Devonian age is composed of weakly metamorphosed, but highly deformed, sedimentary rocks deposited within a continental shelf/slope environment. The formation is composed predominantly of quartz sandstone. Locally, however, it also includes quartzite, chert, carbonaceous phyllite, quartz schist, volcanic flows, breccia, lapilli tuff, volcaniclastic sediments, and carbonate rocks.

Grizzly, Sierra Buttes, Peale, and Reeve Formations: Unconformably overlying the Shoo Fly Complex east of Bowman Lake is a sequence of middle to upper Paleozoic metavolcanic and metasedimentary rocks of island-arc origin. These are divided into the Late Devonian Grizzly Formation (conglomerate and quartzose sandstone), the Late Devonian Sierra Buttes Formation (felsic pyroclastic debris flows and tuffaceous slate), the Carboniferous Peale Formation (tuff-siltstone and chert), and the Permian Reeve Formation (tuff).

Sailor Canyon and Tuttle Lake Formations: East of Bowman Lake, Lower Jurassic tuffaceous sandstone and volcanic conglomerate of the Sailor Canyon Formation unconformably overlie the Reeve and, in places, the Peale Formations. Conformably

overlying the Sailor Canyon Formation is the Middle Jurassic Tuttle Lake Formation, which is composed predominantly of mafic to andesitic volcanic flow and breccia deposits.

CENTRAL METAMORPHIC TERRANE:

The Central metamorphic terrane is bounded on the west by the Gillis Hill fault and by a series of unnamed and poorly defined thrust faults extending through Scotts Valley Reservoir. On the east, the Central metamorphic terrane is bounded by the northern Melones fault (Figure 3; Plates 1a and 1b). Rocks within the Central metamorphic terrane are assigned to the Permian and Triassic Calaveras Complex and to the Triassic Clipper Gap Formation.

Calaveras Complex: Principal rock types making up the Calaveras Complex include moderately metamorphosed chert, argillite, volcanic, and volcanic-derived sediments that were probably deposited in a marginal ocean basin environment in proximity of volcanic activity. Parts of the formation have been highly disrupted into a serpentinite-matrix melange.

Clipper Gap Formation: The Clipper Gap Formation consists of a weakly metamorphosed, but highly disrupted assemblage (melange) of metasedimentary rocks of probable Triassic age (Tuminas, 1983). The principal rock types are chert and argillite which were deposited in a deep ocean basin environment. Also included in the unit are a few isolated carbonate rock bodies. In the southern part of the county, the Clipper Gap Formation underlies volcanic rocks of the Western metamorphic terrane and are exposed in several areas as windows (Plate 1a).

WESTERN METAMORPHIC TERRANE:

The Western metamorphic terrane encompasses most of the area of Nevada County east of the Gillis Hill fault (Figure 3; Plate 1a). Predominant rock types in this terrane are igneous and sedimentary rocks of island-arc origin. The terrane is marked by several regional high-angle faults and a number of low-angle (thrust) faults that juxtapose distinct lithologic assemblages of Mesozoic age. These assemblages have been mapped, described, and named by previous workers as follows:

Smartville Complex: The part of the western metamorphic terrane that is situated between the county line and the Wolf Creek fault consists almost entirely of mafic to intermediate volcanic, hypabyssal, and plutonic rocks which were formed along the magmatic core of an island-arc chain active during the Jurassic. This assemblage of rocks has been referred to as the Smartville Complex (Beard, 1985).

The volcanic rocks of the complex have been divided into a lower unit characterized by mafic pillow lavas and an upper unit which is characterized by andesite breccia and pyroclastic deposits. Exposure of the two units in the western part of the county is controlled by a series of northwest-trending, gently-dipping anticlines and synclines which plunge to the southeast (Plate 1a).

Plutonic rocks of the Smartville Complex include gabbro, diorite, tonalite, granodiorite, massive diabase, mafic dikes, and sheeted mafic dikes. These intrusives, with the exception of the Sierran-type granodiorite plutons (Cretaceous), all appear to be related to Late Jurassic island-arc activity (Beard, 1985).

Lake Combie Complex: The Lake Combie Complex represents an additional volcanic island-arc assemblage similar to, but slightly older (160-180 million years) than, the Smartville Complex (Tuminas, 1983). It is composed of similar rock types that form the Smartville Complex, except that it contains more volcanic-derived metasedimentary rock. The two complexes are separated by a narrow band of melange (Clipper Gap Formation) exposed along the trace of the Wolf Creek fault. The Lake Combie Complex is bounded in part on the east by the Gillis Hill fault and an unnamed thrust fault (Plate 1a).

PLUTONIC ROCKS

Plutonic rocks occur throughout Nevada County, intruding metamorphic rocks of the Western, Central, and Eastern metamorphic terranes, and also occur as small, isolated exposures within the volcanic terrane of the Basin and Range province in the eastern part of the county (Figure 3). Exposed plutons include: (1) Jurassic and Cretaceous Sierra Nevada batholithic rocks and satellite plutonic bodies that are dominated by tonalite, granodiorite, and granite (Bateman, 1988; Bateman and Wahrhaftig, 1966); (2) the Middle to Late Devonian Bowman Lake batholith composed of granite, trondhjemite, tonalite, and granodiorite (Hansen and others, 1988); (3) Jurassic gabbro, diorite, and quartz diorite intrusive bodies associated with the Smartville Complex (Beard, 1985); and (4) serpentinized ultramafic rocks exposed along the traces of major faults (Hietanen, 1981).

TERTIARY SEDIMENTARY ROCKS

Tertiary sedimentary deposits exposed in Nevada County are divided into three units: Eocene channel-fill deposits of the ancestral Yuba River containing clay, silt, sand, and gravel (commonly called "Tertiary gravels"); volcanic-derived sediments of the Oligocene Valley Springs Formation; and volcanic-derived

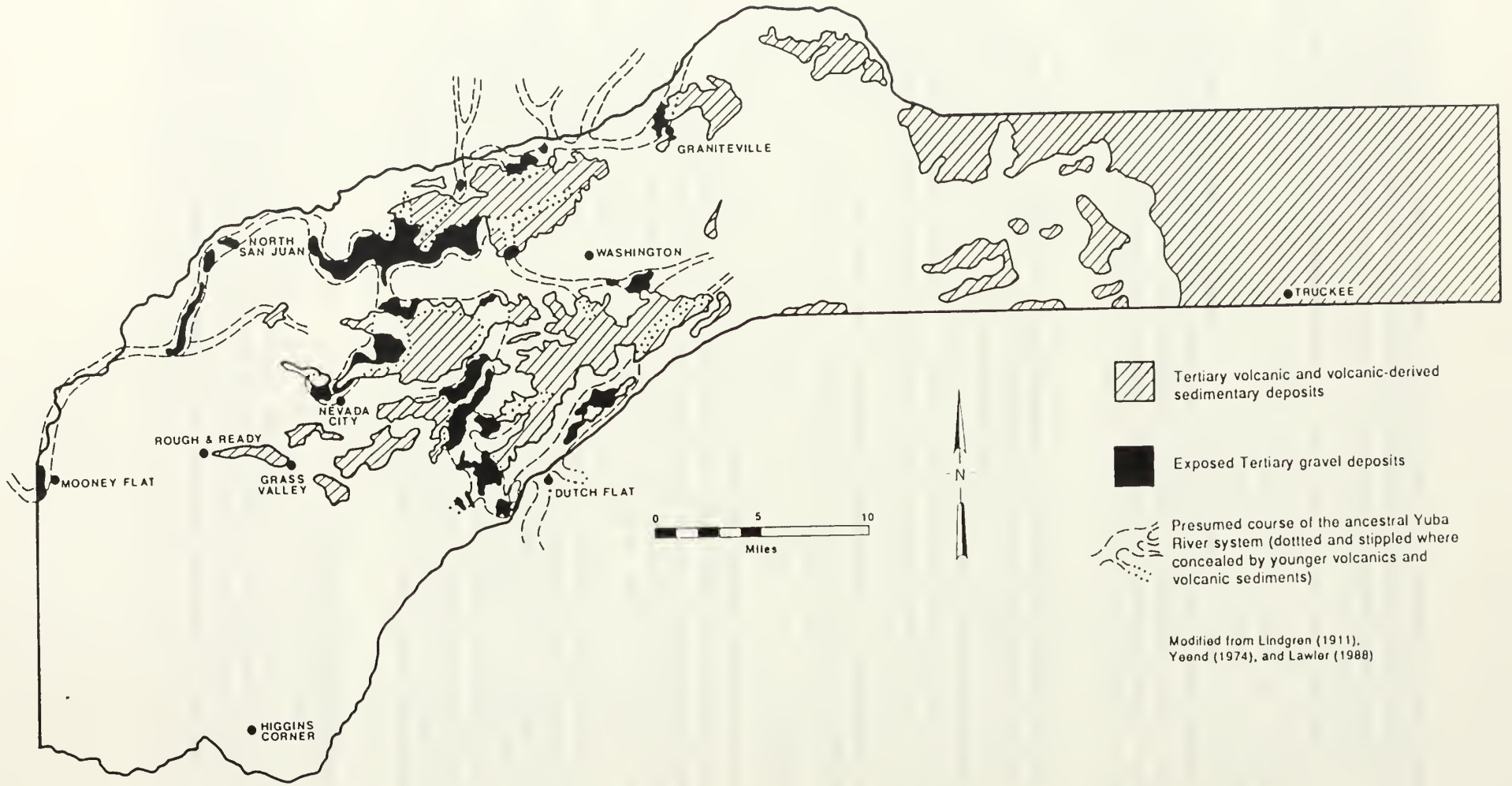


Figure 4. Map of the ancestral Yuba River system and volcanic and volcanic-derived sedimentary deposits of Tertiary and Quaternary age in Nevada County.

sediments and lahar flows of the Miocene Mehrten Formation. These deposits are commonly exposed on ridges separating major drainages in the central and western parts of Nevada County (Figure 4).

TERTIARY VOLCANIC ROCKS

Most of the area of Nevada County east of the Sierra Nevada crest is underlain by Miocene to Quaternary volcanic rocks of the Basin and Range province. The basic rock types included in this province consist of voluminous Miocene and Pliocene andesitic mudflow breccias and lava flows overlain by less extensive Pleistocene mafic volcanic flows, along with volcanic-derived alluvial and lacustrine sediments that fill fault-bounded basins (Latham, 1985).

QUATERNARY SEDIMENTARY ROCKS

Quaternary sedimentary rocks include alluvium, colluvium, landslide deposits, stream and river terrace deposits, stream bed and lake deposits, and glacial deposits. The glacial deposits exposed in the higher Sierra and in the Basin and Range province are the oldest of the Quaternary units. A more detailed description of these Quaternary deposits is included in Part IV of this report.

STRUCTURE

Four major ancient faults (active millions of years ago) extend along northerly trends through Nevada County. These are the northern Melones fault, which separates the Eastern and Central metamorphic terranes, the Gillis Hill fault, which separates parts of the Central and Western metamorphic terranes, and the Weimar-Grass Valley and Wolf Creek faults that juxtapose major rock units within the Western metamorphic terrane (Figure 3). These faults are deep-seated, high-angle structures (Tuminas, 1984). Other ancient faults in the region include a series of low-angle thrust faults in the Western metamorphic terrane spatially associated with the Wolf Creek, Weimar, and Grass Valley faults (Tuminas, 1983), a series of thrust faults in the Central metamorphic terrane extending from Chicago Park through San Juan Ridge (Tuminas, 1983; Hodos, 1983), and a series of thrust faults in the Eastern metamorphic terrane mapped by Schweickert and others (unpublished) in the Bowman Lake area (Plates 1a and 1b).

Normal faults in the Basin and Range province form orthorhombic patterns in eastern Nevada County (Plate 1c), which are attributed to both extensional tectonism and right-lateral shear during late Tertiary time (Latham, 1985).

ECONOMIC GEOLOGY

The distribution and types of mineral deposits present within any given region are governed by the lithologic and tectonic framework of that region (Albers, 1981). For example, oceanic and island-arc terranes intruded by granitoid plutons are known to be particularly favorable geologic environments for the occurrence of lode gold deposits. Also, volcanic and sedimentary rocks formed in island-arc volcanic settings are favorable host rocks for the massive and disseminated sulfide bodies enriched in base and precious metals. Rocks developed in oceanic and island-arc environments, which were later intruded by pluton rock, are the most common rock types exposed in Nevada County. This explains why there are more than 400 gold localities and numerous copper-zinc deposits within the county boundaries.

MINING HISTORY

Mining activity in Nevada County dates back to 1849 when prospectors discovered gold in the rivers and creeks flowing through the area. These initial finds soon led to many more discoveries of placer gold contained within voluminous gravel deposits of ancient river channels exposed in the west central county area, as well as lode gold contained in numerous quartz veins exposed in Nevada City, Grass Valley, and elsewhere. Between 1850 and 1956, when the Empire mine closed, Nevada County produced more gold than any other county in the state, with total production estimated at 15.5 million troy ounces (converted from production value data in Clark, 1970). This is almost twice the amount of gold that has been mined in Amador County, the second largest producer. In the years leading up to World War II, practically all the people in the county were supported directly or indirectly by the local gold mining industry (Logan, 1941; p. 380). Other metals produced in Nevada County since 1880 are silver (production valued at $3 million), copper (1.64 million pounds), lead (1.84 million pounds), zinc (200,000 pounds), chromite (6,000 tons) and small amounts of tungsten (scheelite) and manganese. Industrial minerals produced are barite (200,000 tons), quartz for silicon production (recently initiated), and small amounts of limestone, asbestos, clay, and mineral paint. Also, several tens of millions of tons of construction aggregate have been produced.

Significant deposits of sand and gravel, as well as rock types suitable for use as crushed stone aggregate, are exposed throughout the county, but generally these resources have not been extensively developed due to the county's historic small population. However, dramatic population increases in the last decade (see aggregate demand section) is likely to result in significantly increased development of local aggregate sources.

Important references relating to mineral resource occurrences of Nevada County include Lindgren (1896a; 1896b; 1900; 1911), Whitney (1880), Lindgren and Turner (1895), MacBoyle (1919), Johnston (1940), Logan (1941), Southern Pacific Company (1964), Clark (1970), Yeend (1974), and Lawler (1988). The following is a summary of the mineral deposits associated with the geologic terranes in Nevada County.

DISTRIBUTION OF MINERAL DEPOSITS

EASTERN METAMORPHIC TERRANE

Significant and potentially significant mineral deposits in the Eastern metamorphic terrane include: (1) gold-bearing quartz veins localized along regional, northerly trending fault zones such as those extending through Washington, Holbrook Flat, and Graniteville; (2) exhalative-type sulfide deposits enriched in precious and base metals and barite in volcanogenic rock units; (3) carbonate rock deposits exposed in the Bowman Lake area; and (4) crushed stone resources.

CENTRAL METAMORPHIC TERRANE

Potentially significant mineral deposits associated with the Calaveras Complex and Clipper Gap Formation include (1) gold-bearing quartz veins developed along major fault zones; (2) volcanogenic-type sulfide deposits enriched in gold, silver, copper, lead, zinc, and barite; (3) carbonate rock; and (4) crushed stone resources. The only significant mineral deposits produced thus far from bedrock exposed within the Central metamorphic terrane are barite (Democrat mine), quartz-vein lode gold (Delhi and St. Gothard mines), and construction aggregate (Taylor's crossing of the Bear River).

WESTERN METAMORPHIC TERRANE

Both the upper and lower volcanic units of the Smartville Complex are noted for being host rocks for exhalative-type massive sulfide deposits enriched in copper, zinc, and, in some cases, gold. These same types of deposits could occur in the Lake Combie Complex, but none are known to exist. Fault- and fracture-filling, gold-bearing quartz veins are hosted in a major northerly trending shear-zone within massive diabase and gabbro-diorite in the Deadman's Flat-Kentucky Ridge area (Plate 1a). South of Wolf Mountain, chromite-bearing ultramafic rocks exposed within a complex structural zone branching northwesterly off the Wolf Creek fault zone contain small podiform chromite bodies. Gold-bearing quartz veins of the famous Grass Valley and Nevada City gold mining districts occupy faults and fractures within and adjacent to the Grass Valley and Yuba Rivers plutons. Many rock types exposed in the Western metamorphic terrane could be used for crushed stone resources.

PLUTONIC ROCKS

Many of the gold-bearing quartz veins in the Grass Valley area and those located east of Nevada City are hosted in granodiorite of the Grass Valley and Yuba Rivers plutons (Plate 1a). Lode gold deposits contained in quartz-tourmaline-pyrite veins are hosted by plutonic rocks of the Sierra Nevada batholith in the Meadow Lake, Signal Peak, and English Mountain area (Bowman, 1983; Plates 1b and 1c). Also, possible molybdenum porphyry mineralization is evident in the vicinity of English Mountain (Mineral locality No. 332, Plate 1b). Northerly trending, gold-bearing quartz veins extending between Highway 20 and Graniteville are hosted in granitoid rock of the Devonian Bowman Lake batholith.

TERTIARY ROCKS

Significant mineral resources associated with Tertiary river deposits include placer gold, high-grade quartz cobbles for silicon production, and construction aggregate. Also of importance are rhyolite ash and volcanic clay deposits associated with the Oligocene Valley Springs Formation and illite-kaolinite clay deposits associated with Eocene lateritic soils preserved by overlying Tertiary gravel and volcanic deposits. Although no deposits are known to have been discovered, gold deposits associated with volcanic vents and hot springs can be expected to occur within the thick volcanic deposits of the Basin and Range province east of the Sierra Nevada crest. Volcanic cinder is presently mined in the Truckee area for use as construction aggregate.

QUATERNARY ROCKS

Modern streambed deposits and Pleistocene glacial deposits can be excellent sources of sand and gravel for use as construction aggregate. The suitability of individual deposits for producing aggregate depends on their physical and chemical characteristics, as well as their accessibility.

PART II - THE CALIFORNIA MINERAL LAND CLASSIFICATION SYSTEM

MINERAL RESOURCE ZONES

Areas subject to Mineral Land Classification studies are divided by the State Geologist into various Mineral Resource Zone (MRZ) categories that reflect varying degrees of mineral potential. The MRZ nomenclature and criteria adopted by the State Mining and Geology Board (1983) are graphically portrayed on what is referred to as the California Mineral Land Classification Diagram (Figure 5). Definitions of terms included in the diagram are presented in Appendix B. The diagram is a modification of a mineral resource classification scheme developed by the U.S. Bureau of Mines and the U.S. Geological Survey (1980) that presents a relationship between mineral resource occurrence and economic significance. The horizontal axis of the diagram represents the degree of knowledge about mineral occurrence, while the vertical axis portrays economic characteristics of mineral deposits (grade and size). The diagram may be divided into four parts for the purpose of presenting basic information regarding mineral resource potential of land:

1) **Areas of No Mineral Resource Significance**
2) **Areas of Identified Mineral Resource Significance**
3) **Areas of Undetermined Mineral Resource Significance**
4) **Areas of Unknown Mineral Resource Significance**

MINERAL RESOURCE ZONE (MRZ) CATEGORIES

As shown on Figure 5, each of the above four divisions relates directly to and incorporates one of the four basic Mineral Resource Zone (MRZ) categories established through law and/or State Mining and Geology Board policy. The specific definitions of each MRZ category are given below. Note in both Figure 5 and in the MRZ definitions below that two of the categories (MRZ-2 and MRZ-3) are divided into two subcategories.

MRZ-1: Areas where available geologic information indicates there is little likelihood for the presence of significant mineral resources.

MRZ-2a: Areas underlain by mineral deposits where geologic data indicate that significant measured or indicated resources are present. As shown on the California Mineral Land Classification Diagram, MRZ-2 is divided on the basis of both degree of knowledge and economic factors. Areas classified MRZ-2a contain discovered mineral deposits that are either measured or indicated reserves as determined by such evidence as drilling records, sample analysis, surface exposure, and mine

information. Land included in the MRZ-2a category is of prime importance because it contains known economic mineral deposits.

MRZ-2b: Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present. Areas classified MRZ-2b contain discovered mineral deposits that are either inferred reserves as determined by limited sample analysis, exposure, and past mining history or are deposits that presently are sub-economic. Further exploration work and/or changes in technology or economics could result in upgrading areas classified MRZ-2b to MRZ-2a.

MRZ-3a: Areas containing known mineral occurrences of undetermined mineral resource significance. Further exploration work within these areas could result in the reclassification of specific localities into MRZ-2a or MRZ-2b categories. As shown on the California Mineral Land Classification Diagram, MRZ-3 is divided on the basis of knowledge of economic characteristics of the resources.

MRZ-3b: Areas containing inferred mineral occurrences of undetermined mineral resource significance. Land classified MRZ-3b represents areas in geologic settings that appear to be favorable environments for the occurrence of specific mineral deposits. Further exploration work could result in the reclassification of all or part of these areas into the MRZ-3a category or specific localities into MRZ-2a or MRZ-2b categories.

MRZ-4: Areas of no known mineral occurrences where geologic information does not rule out either the presence or absence of significant mineral resources.

The distinction between the MRZ-1 and MRZ-4 categories is important for land-use considerations. <u>It must be emphasized that MRZ-4 classification does not imply that there is little likelihood for the presence of mineral resources, but rather there is a lack of knowledge regarding mineral occurrence.</u> Further exploration work could well result in the reclassification of land in MRZ-4 areas to MRZ-3 or MRZ-2 categories.

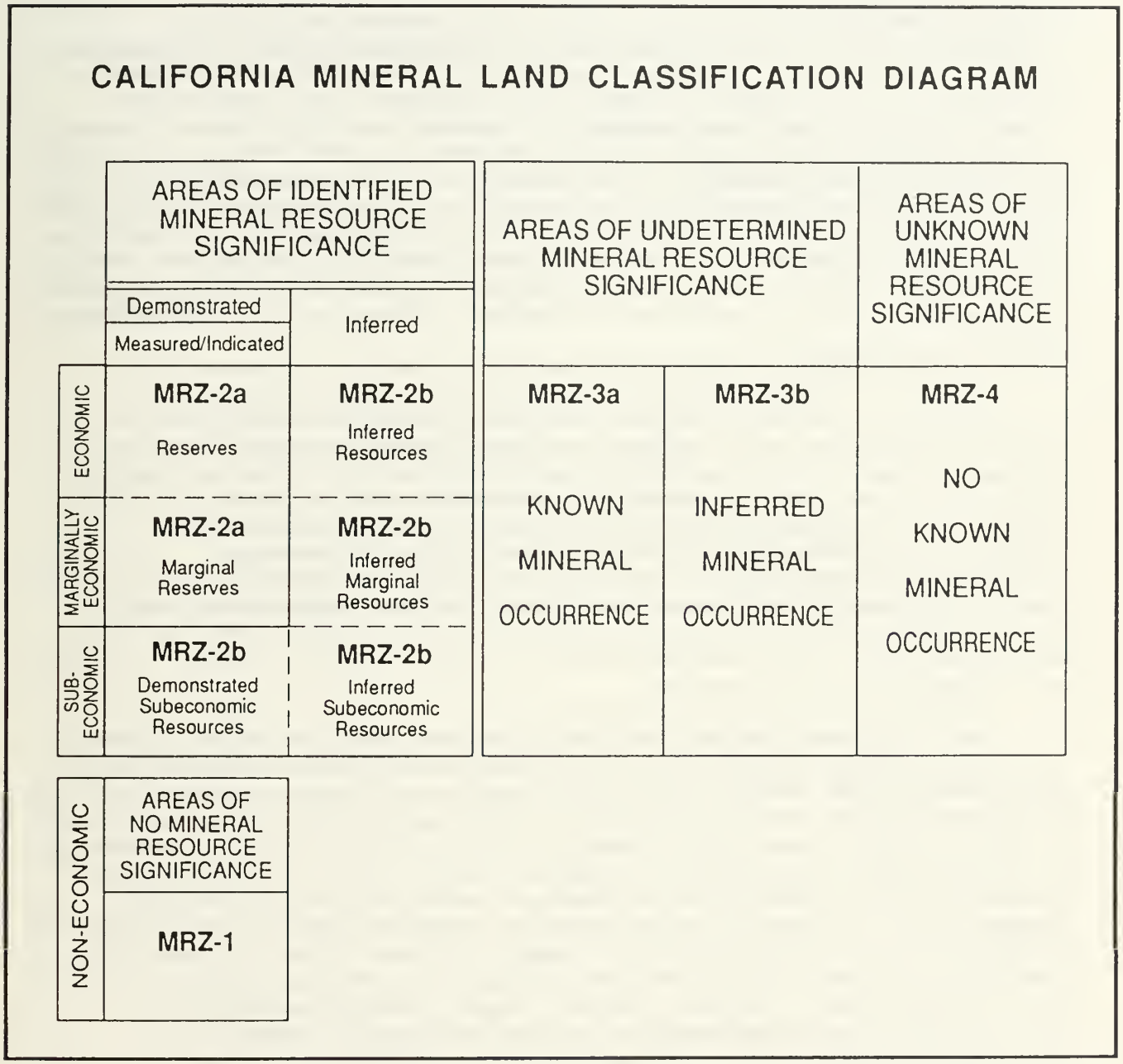


Figure 5. California Mineral Land Classification Diagram.

CLASSIFICATION CRITERIA

To be considered **significant** for the purpose of Mineral Land Classification, a mineral deposit, or a group of mineral deposits that can be mined as a unit, must meet marketability and threshold value criteria adopted by the State Mining and Geology Board (1983, p. 26). The criteria vary for different minerals depending on: (1) whether they are strategic or nonstrategic minerals; (2) their uniqueness or rarity; and (3) their commodity-type category (metallic minerals, industrial minerals, or construction minerals). For example, to be considered significant, the threshold value of the first marketable product for a metallic ore deposit is 500,000 1978 dollars, 1,000,000 1978 dollars for an industrial mineral deposit, and 5,000,000 1978 dollars for a construction aggregate deposit (multiply 1978 dollars by 1.94 to calculate threshold value in 1989 dollars).

DATA PRESENTATION

Mineral land classification addresses specific types of mineral deposits which occur, or are likely to occur, in the project area. The type of mineral deposit for which a particular area is classified is denoted in the text and on maps of this report by a superscript letter following the assigned MRZ category (for example, MRZ-2b$^{(h)}$ for deposits formed by hydrothermal processes). Also, superscript reference numbers are used to identify and reference specific MRZ areas discussed in the report and displayed on the maps (for example, MRZ-2b$^{(h-5)}$ would be the fifth area described in the text for deposits formed by hydrothermal processes).

Map information that accompanies the text of this report is presented at a scale of 1:48,000 (one inch equals 4,000 feet). Map coverage of Nevada County at this scale is presented in a set of three plates covering the western, central, and eastern thirds of the county. For example, Plate 1a displays the geology of the western one-third of Nevada County, Plate 1b the central one-third, and Plate 1c the eastern one-third. Accordingly, Plates 2a, 2b, and 2c of this report display all areas classified as MRZ-2 for all minerals, in composite form, for the western, central, and eastern thirds of the county, respectively. Plates 3a-c through 6a-c present mineral land classification for individual genetic classes of mineral deposits, such as hydrothermal deposits, placer deposits, industrial minerals, and construction aggregate. Plates 7a-c display land identified as Aggregate Resource Areas (ARA's), which are areas where it is judged that existing land use does not necessarily preclude aggregate mining activity. See the list of plates in the Table Of Contents section for specific maps included in this report.

PART III - MINERAL LAND CLASSIFICATION, METALLIC AND INDUSTRIAL MINERAL RESOURCES

MINERAL DEPOSITS SUBJECT TO CLASSIFICATION IN NEVADA COUNTY

The Nevada County study area has been classified for the presence or likely occurrence of metallic and nonmetallic minerals (see following section for mineral land classification for construction aggregate resources). Consideration is given to all nonfuel minerals of potential economic importance by determining what genetic classes of metallic and nonmetallic mineral deposits are likely to occur within the area. There are ten genetic classes that have been chosen for consideration. These are:

1. Deposits formed by hydrothermal processes.
2. Deposits formed by contact metasomatism.
3. Deposits formed by magmatic segregation.
4. Deposits formed by sedimentation.
5. Deposits formed by metamorphism.
6. Deposits formed by evaporation.
7. Deposits formed by residual concentration.
8. Deposits formed by mechanical concentration.
9. Deposits formed by bacteriological processes.
10. Industrial mineral deposits formed by diverse processes.

Only those genetic classes for which direct or indirect evidence indicates the presence or likely occurrence of significant deposits are addressed in the mineral land classification report. However, there may exist other types of deposits which, because of lack of evidence, are not presently recognized.

Of the ten genetic classes listed, four are judged to be, or likely to be, present in the project area. These are as follows:

1. Deposits formed by hydrothermal processes (precious and base metals).
2. Deposits formed by mechanical concentration (placer gold).
3. Deposits formed by magmatic segregation (chromite).
4. Industrial mineral deposits formed by diverse processes (barite, quartz cobbles for silicon production, carbonate rock (limestone), clay, talc, and asbestos).

Following are descriptions of the areas classified MRZ-2 and MRZ-3 for the above types of mineral deposits except for construction aggregate resources, which are addressed separately

in Part IV of this report. All areas classified as MRZ-2 for all minerals, including construction aggregate, are presented in composite form on Plates 2a-c. Mineral Resource Zones relative to each genetic class of metallic and industrial minerals are presented on Plates 3a-c (hydrothermal deposits), 4a-c (placer deposits), and 5a-c (industrial minerals and magmatic segregation). Construction aggregate resources are depicted on Plates 6a-c and 7a-c.

AREAS CLASSIFIED FOR DEPOSITS FORMED BY HYDROTHERMAL PROCESSES

PRECIOUS AND BASE METAL RESOURCES

Areas classified exclusively for mineral deposits formed by hydrothermal processes are displayed on Plate 3a-c. Mine and prospect localities also are plotted on Plate 3a-c, as well as on Plate 2a-c, which displays the composite MRZ-2 areas for all minerals. Hydrothermal deposits include epigenetic-type deposits, such as mineralized quartz veins, as well as syngenetic-type deposits, such as volcanogenic massive and/or disseminated sulfide bodies. Worldwide, these types of deposits represent major sources of metallic minerals and, to a lesser extent, nonmetallic minerals. In Nevada County metallic minerals that historically have been mined include gold, silver, copper, lead, zinc, and tungsten. Barite and some clay deposits mined or prospected in Nevada County also were formed through hydrothermal processes, but are addressed in the Industrial Minerals section of Part III.

Areas Classified MRZ-2a$^{(h)}$

MRZ-2a$^{(h-1)}$ - San Juan Mine (lode gold, copper, zinc): Exploration work conducted by Amax Exploration Company during the mid-1980's at the San Juan mine (Locality No. 43, Plate 3a), which included geologic mapping, drilling, geochemical analyses, and geophysical surveying, has demonstrated the presence of a significant volcanogenic-type banded massive and disseminated sulfide deposit enriched in gold, copper, and zinc. The main ore body, which can be traced at the surface by exposed gossan, strikes north, dips vertically, and measures about 1,600 feet in length and 40 to 60 feet in width. Drilling, which was limited to 100 feet, shows the oxide zone is 60 feet deep, below which the sulfide zone extends vertically to unknown depth. Located about 500 feet southwest of the main ore body is a smaller, unexplored sulfide lens oriented north and measuring 600 by 30 feet. Based on the amount of exploration work completed to date, the copper, zinc, and gold contents of both deposits are placed into the resource category of indicated reserves. No activity is reported on the property at present time.

MRZ-2a$^{(h-2)}$ - Lower Spanish Mine (lode gold, silver, copper, lead, zinc): Exploration conducted by Cedar Resources, Inc. during the past three years at the Spanish mine (Locality No. 68, Plate 3b), which has involved geologic mapping, drilling, geochemical analyses, and geophysical surveying, has demonstrated the presence of significant gold-silver-copper-lead-zinc mineralization within massive and disseminated sulfide deposits hosted in phyllite of the pre-Late Devonian Shoo Fly Formation. The northerly-trending, 100-foot wide main ore body can be traced along the surface for at least 1,800 feet. Mineralization extends to a depth in excess of 400 feet down dip at 60 degrees to the west. The area classified MRZ-2a$^{(h-2)}$ includes only the segment of the mineralized zone along which exploration drilling has blocked out indicated and measured precious and base metal reserves. Significant mineralization is inferred to continue both north and south into the area classified MRZ-2b$^{(h-13)}$.

MRZ-2a$^{(h-3)}$ - Meadow Lake Mine (lode gold): Significant indicated and measured gold reserves have been delineated at the Meadow Lake (Excelsior) mine (Locality No. 328, Plate 3b) by exploration drilling conducted in the mid-1980's by Callahan Mining. Gold mineralization occurs locally along a series of north-northwest-striking, cavity-filling quartz-tourmaline-pyrite veins hosted in granodiorite in the vicinity of Meadow Lake. Parts of the vein system presently are being mined by Kelmine Corp., Utah. The abundance of tourmaline in the veins, the intense and pervasive sericitic alteration of granodiorite over a wide area, the presence of Mesozoic volcanic rocks in the immediate area, and the occurrence of a vein-hosted molybdenum prospect (Locality No. 334, Plate 3b) located nearby suggest that the mineralization could be associated with a sub-volcanic island-arc porphyry system (Bowman, 1983).

Areas Classified MRZ-2b$^{(h)}$

MRZ-2b$^{(h-4)}$ - Spenceville Mine (copper, lode gold, silver): This area contains a massive sulfide deposit enriched in copper, gold, and silver that is hosted in volcanic rocks of the Late Jurassic age Smartville Complex. Copper was discovered at Spenceville in the early 1860's (Locality No. 51, Plate 3a). From 1875 to 1887 about 150,000 tons of ore averaging five percent copper was mined from this locality. Since the ore was recovered from relatively shallow depths (maximum of 150 feet), additional copper and gold resources are inferred to exist at depth and along strike.

MRZ-2b$^{(h-5)}$ - Iron Mountain/Robinson Ranch (copper, zinc): Historic mining and geologic investigations, exploration drilling, geochemical sampling, geophysical surveying conducted in the late 1950's and early 1960's by Sharon Steel, in the mid-1970's by Superior Oil Company, and again in part during the mid-1980's by Nevcan Exploration, Inc., indicate that significant

inferred base and precious metal resources are present within this area. Evidence of volcanogenic massive sulfide mineralization hosted in Late Jurassic volcanic island-arc rocks of the Smartville Complex is recognized at several separate localities within the area, including the Taylor Iron Mountain mine deposit (Locality No. 47, Plate 3a), which was developed in the early 1900's as a copper and gold prospect. Nevcan Exploration, Inc. data evaluated in the course of this study indicate that the Taylor Mountain ore body contains about 0.9 million tons grading 2.27 percent copper and 0.02 ounces per ton gold to a depth of 250 feet below the surface. Additional significant resources are inferred to exist at deeper levels. Although no exploration drilling has been conducted at the other target localities on the Robinson Ranch property, systematic geochemical sampling and geophysical surveys indicate there is a high likelihood for additional base and precious metal resources of potential economic significance.

MRZ-2b$^{(h-6)}$ - Waddle Iron Mountain (copper, zinc): Geologic investigations, exploration drilling, geochemical sampling, and geophysical surveying conducted in the mid-1970's by Superior Oil Company and in part during in the mid-1980's by Nevcan Exploration, Inc. indicate that significant inferred base and precious metal resources are present within this area (Locality No. 54, Plate 3a). Massive sulfide bodies and stringers are hosted in Late Jurassic felsic volcanic rocks of the upper volcanic unit of the Smartville Complex. These deposits occur within a large north-northwest-trending quartz-sericite-pyrite alteration zone measuring 7,200 by 5,000 feet. The alteration zone is truncated on the east and on the north by a large granodiorite intrusive body. Also present are an extensive area of silicification measuring 1,500 by 800 feet and at least four gossan zones. Four bore holes drilled by Superior Oil Company each intersected multiple massive sulfide horizons containing anomalous copper and zinc values. There has been no recorded production from these deposits except for small amounts of paint pigment produced from gossan bodies.

MRZ-2b$^{(h-7)}$ - Pine Hill Mine (lode gold): The Pine Hill mine (Locality No. 58, Plate 3a) is situated about 3 miles northwest of Higgins Corner. Here, a series of northerly-striking quartz, barite, and calcite veins enriched in base and precious metals are exposed on and around Pine Hill within a zone of intensely altered diabase. The alteration zone, characterized by the presence of kaolinite, quartz, and illite, was mapped and described by Lindgren (1892) as measuring about 1 mile long by 1,000 to 2,000 feet wide, centered on Pine Hill. Historic gold production and the extent of intense hydrothermal alteration observed at this property indicate that significant inferred gold resources are present. The property also has potential for the industrial clay, kaolinite (see MRZ-3a$^{(i-5)}$).

MRZ-2b(h-8) - Deadman's Flat Area (lode gold): Historic mining activity and field observations suggest that significant inferred gold resources are contained within this area. Gold mineralization is associated with a system of numerous 1- to 3-foot wide quartz veins that occupy northerly- and easterly-trending faults and fractures that cut diabase, gabbro, and diorite intrusive rock of the Smartville Complex. Mines which have produced significant amounts of gold in this area include the Alcalde, Pittsburg, Normandy-Dulmaine, Osceola, and Black Bear (Locality Nos. 95, 91, 93, 86, and 78, Plate 3a). The ore contains free milling gold, as well as localized concentrations of pyrite, galena, and chalcopyrite. Most of the quartz veins which have been mined in this area have been developed to relatively shallow depths. Additional gold resources are likely to exist at deeper levels, as well as along strike, and it is likely that numerous gold-bearing quartz veins, and possibly zones of mineralized country rock (disseminated microscopic gold) within the district system have not been discovered.

MRZ-2b(h-9) - Grass Valley South Area (lode gold): This area encompasses a series of cavity-filling quartz-carbonate-ankerite veins containing free gold and lesser amounts of lead, copper, zinc, and tungsten. Included within this area are the historic Empire and North Star mines (Locality Nos. 222 and 202, Plate 3a). Most of the veins, which normally range from 1 to 10 feet in thickness, either occupy northerly-trending, gently west-dipping or westerly-trending, gently north-dipping faults located in proximity to the contact of the 5-mile long by 1- to 2-mile wide Grass Valley pluton (granodiorite) and the surrounding diabase country rock. Although many veins have been mined to great depth (some workings extend to about 11,000 feet down dip), significant amounts of gold are likely to exist at yet deeper levels. Also, significant gold resources are likely to exist along some sections of veins which were previously uneconomic or never explored. Milling ore in most veins typically ranged between 0.25 and 0.5 troy ounces per ton. The geology, ore deposits, selected mines and the mining history of the Grass Valley district have been best described in detail by Johnston (1940) and summarized in Clark (1970).

MRZ-2b(h-10) - Grass Valley Northeast Area (lode gold): This area encompasses a complex system of cavity-filling quartz veins that occupy a network of faults and fissures situated between the Grass Valley and Weimar fault zones (Plate 1a). Historic mines in this area include the Idaho - Maryland mines (Locality Nos. 178 and 179, Plate 3a). Although many veins have been mined to great depth, significant amounts of gold are likely to exist at yet deeper levels. Also, significant gold resources are likely to exist along some sections of the vein system which were previously uneconomic or never explored. The geology, ore

deposits, selected mines and the mining history of the Grass Valley district have been best described in detail by Johnston (1940) and summarized in Clark (1970).

MRZ-2b$^{(h-11)}$ - Nevada City West Area (lode gold): This area encompasses an extensive quartz vein system extending through and to the west of Nevada City. Historic mines in this area include the Champion mine (Locality No. 123, Plate 3a). The veins are hosted in northerly-trending, steeply dipping faults and fissures that occur in proximity to the contact between granodiorite of the Yuba Rivers pluton and metamorphosed igneous and sedimentary rocks of the Lake Combie Complex. Substantial amounts of gold have been produced from these cavity-filling quartz veins, but significant gold resources are likely to exist in previously uneconomic veins and in the unmined, down dip extensions of once productive ore shoots.

MRZ-2b$^{(h-12)}$ - Nevada City East Area (lode gold, silver): This area encompasses a series of generally east-trending quartz veins hosted mainly in granodiorite and diorite of the Yuba Rivers pluton. Substantial amounts of gold have been produced from fracture and fault-filling quartz veins located in the Willow Valley and Banner Mountain areas. Historic mines in this area include the Hoge and Murchie mines (Locality Nos. 150 and 160, Plate 3a). Most of the veins strike easterly or northeasterly with gentle dips to the north. A few strike northerly with gentle dips to the east. Many of the quartz veins appear to be controlled by a dominant joint pattern in the pluton and can be characterized as narrow, high grade gold-bearing veins containing abundant sulfides and remarkably high silver content. Significant gold resources are likely to exist in previously uneconomic veins and in the unmined, down dip extensions of developed ore bodies.

MRZ-2b$^{(h-13)}$ - Washington Trend (lode gold): This area encompasses a mineralized, regional structural zone extending along the east margin of the Melones fault zone (Plate 1b). The zone includes both vein-type lode gold deposits and disseminated polymetallic sulfide deposits (exhalative) within volcanic-derived strata assigned to the Shoo Fly Complex. The northern continuation of this structural zone hosts the gold-bearing quartz veins of the Alleghany District. Historic mining activity, recent exploration work, and observations made in the course of this study indicate that the Washington trend is a well-defined mineralized zone that is likely to contain additional precious and base metal deposits of economic interest. Historic mines located within this zone that have had notable gold production include the Red Ledge, German Bar, and Lower Spanish (Locality Nos. 271, 258, 68, Plate

3b). Exploration drilling and mine feasibility studies are currently being conducted at the Lower Spanish by Cedar Resources, Inc. (see MRZ-2a$^{(h-2)}$).

MRZ-2b$^{(h-14)}$ - Holbrook Flat Trend (lode gold): This area encompasses a series of mineralized quartz veins hosted in a northerly-trending, regional structural zone extending through metasedimentary rock assigned to the early Paleozoic Shoo Fly Complex. Historic mining activity and observations made during the course of this study indicate that the trend is a well-defined mineralized structural zone that is likely to contain significant inferred gold resources. Historic mines located within this zone which have had significant gold production in the past include the Zeibright, Ancho-Erie, Republic, and National (Locality Nos. 288, 279, 277-278, 276, Plate 3b).

MRZ-2b$^{(h-15)}$ - Graniteville Trend (lode gold): This area encompasses a northerly-trending, 4-mile long by 1/2-mile wide mineralized structural zone extending along the western contact zone of the Bowman Lake batholith and metasedimentary rocks of the Shoo Fly Complex. Historic gold production, mine document examination, and observations made during the course of this study indicate that the area is a well-defined mineralized structural zone that is likely to contain significant inferred gold resources. Historic lode gold mines located within this zone include the Hotwater, Gaston, and Rocky Glen (Locality Nos. 289, 280, and 293, Plate 3b).

MRZ-2b$^{(h-16)}$ - Graniteville East Trend (lode gold): This area encompasses a series of mineralized quartz veins hosted in a northerly-trending, 1-mile wide structural zone cutting through the Bowman Lake batholith. Historic mining activity, recent industry exploration work, and observations made during the course of this study indicate that the area is a well-defined mineralized structural zone that contains significant inferred gold resources. Historic gold producing mines located within this zone include the Birchville, Jim, Mountain View, Yuba, and Eagle Bird (Locality Nos. 296, 300, 312, 317, and 321, Plate 3b).

Areas Classified MRZ-3a$^{(h)}$ and MRZ-3b$^{(h)}$

MRZ-3a$^{(h-17)}$ - Western County Region (copper, zinc, lode gold): This area is underlain by volcanic rocks (Smartville Complex) that host syngenetic massive sulfide deposits enriched in copper, zinc, and locally gold. These deposits appear to occur along the strike length of certain stratigraphic horizons that are repeated along the limbs of a series of northwest-trending folds (Plate 1a). At least two such horizons are present, one in the lower mafic volcanic unit and one in the upper intermediate volcanic

unit. Significant copper, zinc, and gold resources also could exist in known prospects located in this zone that have not been adequately explored.

MRZ-3a$^{(h-18)}$ - Wolf Creek/Grass Valley Faults (lode gold): Cavity-filling, locally gold-bearing quartz veins occupy fractured and sheared rock along the strikes of the ancient Wolf Creek and Grass Valley faults. Some veins have yielded significant amounts of gold in past years. The Stockton Hill, Belle of France, and the Empress mines (Locality Nos. 101, 97, and 76, Plate 3a) are several of the notable gold mines located within this structural zone.

MRZ-3a$^{(h-19)}$ - Foote Crossing Area (lode gold): This area contains a series of northerly-trending gold-bearing quartz veins that in the past have been mined successfully mainly by the Delhi-St. Gothard mine operation (Locality No. 245, Plate 3a). There are no indications in the literature (Logan, 1941) that mining depleted the gold resources contained within the veins. Since gold-bearing quartz mined in the Sierra Nevada typically extends to depths of thousands of feet below the surface with no apparent change in ore grade, it is likely that significant amounts of gold resources are present within undeveloped parts of these veins at depth and along strike.

MRZ-3a$^{(h-20)}$ - Gillis Hill Fault (lode gold): Cavity-filling, locally gold-bearing quartz veins occupy fractured and sheared rock associated with a regional, northerly-trending fault zone that extends through Nevada County between the Chicago Park and North Bloomfield areas. Historic gold mines and prospects located along the Gillis Hill fault zone include the Carter Group, Arrowhead, Orona, and Mountain Maid (Locality Nos. 248, 249, 250, 252, Plate 3a). Although concealed in large part by ridge-capping volcanic and sedimentary deposits of the Tertiary Mehrten Formation, additional gold-bearing quartz veins that could contain significant gold resources are likely to occur along the trace of the Gillis Hill fault zone.

MRZ-3a$^{(h-21)}$ - Junction House Area (lode gold, barite): This represents a poorly-defined, northerly-trending mineralized zone extending through Nevada County along the west side of the northern Melones fault zone. The partially concealed belt contains cavity-filling, locally gold-bearing quartz veins and hydrothermally altered rock, and includes at least one barite deposit, the Democrat mine (see MRZ-2b$^{(i-2)}$; Locality No. 3, Plate 5b;), which is interpreted to have been formed by submarine hot spring activity. Such barite deposits are often spatially associated with massive or disseminated sulfide bodies enriched in base and/or precious metals. Country rock is composed of intermediate to felsic volcanic flows, tuff, volcanic-derived clastic sediments, and argillite assigned to the Permian-Triassic Calaveras Complex.

MRZ-3b(h-22) - Washington South Area (lode gold): This area is the extrapolated southward continuation of MRZ-2b(h-13) (Plate 3b). Although no prospects are known to be located within the zone, additional lode gold deposits within this zone are likely to be concealed by ridge-capping Tertiary volcanic deposits of the Mehrten Formation.

MRZ-3a(h-23) - Bowman Lake Area (lode gold): This area follows the contact region of the Bowman Lake batholith and metasedimentary rocks of the Shoo Fly Complex. Located within the area are several gold mines/prospects, including the historic Yellow Metal mine (Locality No. 325, Plate 3b), that appear to have been developing a system of gold-bearing quartz veins that occupy fissures and fractures formed along the intrusive contact. Additional gold resources are likely to occur within this system.

MRZ-3a(h-24) - French Lake Area (lode gold): This crescent-shaped area encompasses Red Mountain, Old Man Mountain, Meadow Lake, French Lake, and English Mountain (Plate 3b/3c). It contains quartz and quartz-tourmaline-pyrite veins locally enriched in gold such as those presently being mined at the Meadow Lake mine (MRZ-2a (h-3); Locality No. 328; Plate 3b/3c). Copper at English Mountain and molybdenum (Locality Nos. 326 and 334, Plate 3b) also have been reported (Southern Pacific Company, 1959). The ore forming process(es) leading to the occurrence of these deposits is not presently understood. As indicated by the presence of tourmaline and molybdenum, the deposits probably represent porphyry-type mineralization associated with Jurassic island-arc plutonism.

AREAS CLASSIFIED FOR PLACER DEPOSITS

PLACER GOLD RESOURCES

Areas classified for placer deposits are displayed on Plates 4a-c. In Nevada County, early Tertiary channel-fill deposits (gold-bearing gravel) of the ancient Yuba River and its tributaries (Figure 4) have been major sources of placer gold. Other heavy minerals such as zircon, ilmenite (titanium oxide), and chromite also can be produced from placer deposits, but the economic significance of these resources in Nevada County is questionable. Therefore, mineral land classification relative to placer deposits in this report is done primarily for gold resources.

Although commonly mined for gold using suction dredges and panning methods, modern river and stream beds in Nevada County are not classified for placer deposits except along sections where significant sediment deposition is recognized. Most

reaches of the modern rivers and creeks are unlikely to contain threshold value of gold as established by the State Mining and Geology Board (1983).

Areas Classified MRZ-2a$^{(p)}$

MRZ-2a$^{(p-1)}$ - San Juan Ridge West (placer gold): Substantial measured and indicated placer gold reserves are contained in voluminous amounts of unmined Tertiary gravels exposed on San Juan Ridge between Badger Hill and Malakoff Diggings (Locality No. 356, Plate 4a). The Tertiary river deposits contained in the 9-mile length of this partially exposed, 1/2- to 1-mile wide, 600-foot deep channel amount to 800 million cubic yards of clay, silt, sand, and gravel carrying an overall average grade of gold of about 0.005 troy ounces per cubic yard (Jarman, 1927; Yeend, 1974). Part of this area was previously classified MRZ-2 (Loyd, 1983) in response to a petition submitted by Placer Service Corporation for classification of 2,000 acres owned by San Juan Ridge Gold Company. Presently, Battle Mountain Gold Company is conducting a feasibility study to open-pit mine parts of the deposit in the North Columbia area (Locality No. 358, Plate 4a).

Areas Classified MRZ-2b$^{(p)}$

MRZ-2b$^{(p-2)}$ - Mooney Flat (placer gold): Significant inferred placer gold resources remain in this partially mined ancient river channel deposit exposed within a 235-acre property on Mooney Flat Hill (Locality No. 335, Plate 4a). Over 8 million cubic yards of material with an estimated overall grade in excess of 0.005 troy ounces per cubic yard (based on descriptions in Whitney, 1880) are calculated to be present.

MRZ-2b$^{(p-3)}$ - French Corral/Birchville (placer gold): Significant inferred placer gold resources exist in a partially mined segment of an ancient river gravel deposit that measures up to 150 feet thick and 600 feet wide exposed on a 0.85-square-mile property located between Birchville and French Corral (Locality Nos. 339 and 340, Plate 4a). Lindgren (1911) estimated that about 32.5 million cubic yards of material was mined from this area and that 10 million cubic yards of gold-bearing gravels remain. Presently, a 10-acre area of the Tertiary gravels is being open-pit mined by French Corral Corporation. The placer gold resources contained within the French Corral-Birchville area are estimated to be valued in the low tens of millions of dollars.

MRZ-2b$^{(p-4)}$ - Sailor Flat/Blue Tent (placer gold): Significant inferred placer gold resources are contained within unmined ancient river channel deposits exposed over a 1.27-square-mile area at Sailor Flat/Blue Tent Diggings located 4 miles northeast of Nevada City (Locality Nos. 362 and 363, Plate 4a). Lindgren (1911) reported that about 15 million cubic yards of material

were removed by hydraulic mining methods (prior to 1884) and that 90 million cubic yards of material remain. Significant mining has not occurred in the area since 1884. According to Lindgren (1911), the Tertiary river deposits of the Blue Tent/Sailor Flat area contain a considerable amount of "nearly barren" sand. He reports that the gravel-rich lower part of the deposit contains about 0.0075 troy ounces per cubic yard of material, while the sandy upper part contains about 0.0015 troy ounces per cubic yard (converted from cents/yard). The placer gold resources contained within the Sailor Flat/Blue Tent deposit are estimated to be valued in the low tens of millions of dollars.

MRZ-2b$^{(p-5)}$ - Quaker Hill/You Bet (placer gold): Significant inferred placer gold resources remain in large quantities of unmined ancient river channel deposits partially exposed over an area of 5.8 square miles located between Scotts Flat Reservoir and You Bet Diggings (Locality Nos. 367 and 376, Plate 4a). Historic hydraulic mines within this zone include Scotts Flat, Quaker Hill, Hunts Hill, Buckeye Ridge, and the Red Dog-You Bet Diggings. Based on data provided by Lindgren (1911), available ancient river deposits exposed between Quaker Hill and You Bet Diggings are estimated to be in excess of 2.5 million cubic yards and contain placer gold resources valued in the low hundreds of millions of dollars.

MRZ-2b$^{(p-6)}$ - Relief Hill (placer gold): Significant inferred placer gold resources are contained in partly mined ancient river channel deposits exposed within 1.2 square miles of land located on the south side of San Juan Ridge about 3 miles west of the town of Washington (Plate 4b). Logan (1941) reported that about 6 million cubic yards of gravel were mined at Relief Hill and Jarman (1927) estimated that up to 15 million cubic yards of Tertiary gravels remain. The gravels exposed at Relief Hill measure more than 150 feet deep. The placer gold resources contained within the exposed parts of the Relief Hill deposit are estimated to be valued in the low tens of millions of dollars. Evidence of recent drift mining activity at the Relief Hill deposit was observed during this study at the Blue Lead mine (plotted as part of Relief Hill Diggings, No. 385, Plate 4b).

MRZ-2b$^{(p-7)}$ - Lowell Hill Ridge (placer gold): Significant inferred placer gold resources are contained within a 2-square-mile area encompassing a partly mined ancient river channel deposit on Lowell Hill Ridge (Plate 4b). The deposits, which range from 30 feet thick on the northeast to 60 feet thick on the southwest, are concealed in large part beneath younger volcanic sediments of the Mehrten and Valley Springs formations that cap most of the ridge. Lindgren (1911) estimates that about 2 million cubic yards of material were mined and that about 16 million remain. Unlike most other Tertiary gravel localities, Lowell Hill was not extensively mined by hydraulic methods because the overburden, composed mostly of heavy clay, made it

difficult. However, significant development of the higher grade parts of the Lowell Hill channel deposits has been done through drift mining such as at the Oro drift mine (No. 398, Plates 2b, 4b). The placer gold resources contained within the Lowell Hill deposit are estimated to be valued in the low tens of millions of dollars.

MRZ-2b$^{(p-8)}$ - Omega Diggings (placer gold): Significant inferred placer gold resources are contained within partly mined ancient river channel deposits exposed over a property encompassing about 1 square mile located 2 1/2 miles southeast of the town of Washington (Plates 2b, 4b). Logan (1941) reported that about 13.5 million cubic yards of material averaging about 0.0068 troy ounces per cubic yard (converted from cents/yard) were mined from the deposit and that about 25 million cubic yards remain. The placer gold resources existing at the Omega Digging are estimated to be valued in the medium to high tens of millions of dollars.

Areas Classified MRZ-3a$^{(p)}$ and MRZ-3b$^{(p)}$

MRZ-3a$^{(p-9)}$ - North San Juan (placer gold): This area encompasses about 0.5 square miles of exposed Tertiary gold-bearing gravel deposits in and around the town of North San Juan (Locality No. 336, Plate 4a). The deposit was mined extensively by hydraulic methods prior to 1885. Lindgren (1911) estimated that about 20 million cubic yards of material were mined and that 2 million cubic yards remain. It is questionable whether this deposit would meet minimum threshold value criteria adopted by the State Mining and Geology Board (1983) to be considered a significant placer gold deposit.

MRZ-3a$^{(p-10)}$ - Montezuma Hill Area (placer gold): Tertiary gravel deposits measuring about 130 feet thick are concealed in large part by 350 feet of volcanic sediments of the Mehrten Formation that cap Montezuma Hill located 4 miles northwest of Nevada City (Plate 4a). Most of the placer gold production from Montezuma Hill was done between 1853 and 1875 by drift mining at the Montezuma Hill drift/hydraulic mine (Locality No. 341, Plate 4a; Whitney, 1880). Very little hydraulic mining was done here because of thick overburden. Exposed on an unnamed hill located 1 1/2 miles north are erosional remnants of possibly the same channel fill material. It is questionable whether this deposit would meet minimum threshold value criteria adopted by the State Mining and Geology Board (1983) to be considered a significant placer gold deposit under current economic conditions.

MRZ-3b$^{(p-11)}$ - Montezuma Ridge (placer gold): Montezuma Ridge, which is located about 5 miles north of Nevada City (Figure 4a), is capped by volcanic and volcanic-derived sedimentary deposits of the Valley Springs Formation. Because deposition of this

formation was normally confined to low-lying areas such as stream valleys of the early- to mid-Tertiary landscape, the formation often overlies and conceals Tertiary gold-bearing gravel deposits, such as those exposed on the adjacent San Juan Ridge.

MRZ-3b(p-12) - Columbia Hill (placer gold): A Tertiary gold-bearing gravel deposit exposed along the slopes of Columbia Hill located 9 miles north-northeast of Nevada City (Locality No. 358, Plate 4a) was extensively mined by hydraulic methods prior to 1880 (Whitney, 1880). The presumed southward continuation of the ancient channel containing additional Tertiary gravel deposits is concealed below volcanic and sedimentary rocks of the Mehrten and Valley Springs formations.

MRZ-3b(p-13) - San Juan Ridge East (placer gold): The interpreted eastward continuation of the ancient Yuba River channel from Malakoff Diggings, located 8 miles northeast of Nevada City, is concealed below a thick section of Tertiary volcanic rocks capping the east parts of San Juan Ridge (Plate 4b; Figure 4). Although high-grade segments of the buried channel are reported to have been accessed by several early drift mines, including the extensive workings of the Derbec mine (Lindgren, 1911; Locality No. 366, Plate 4a), there is inadequate information concerning the extent and significance of the concealed Tertiary gravel deposits.

MRZ-3a(p-14) - Grass Valley/Nevada City (placer gold): Several ancient channels of limited lateral extent, which are mostly concealed beneath younger volcanic and volcanic sediments, have been developed in the Grass Valley/Nevada City area by hydraulic mining methods (for example, the Manzanita and Howe mines; Locality Nos. 350 and 347, Plate 4a) and drift mining methods (for example, the Alta Hill Mine; Locality No. 344, Plate 4a). These channels are generally thought to represent small tributaries of the main channel of the ancient Yuba River as depicted on Figure 4. Although known channel deposits in the Grass Valley-Nevada City areas have been mined extensively through both hydraulic and drift mining methods, it is possible that undeveloped placer gold resources could remain in partially mined channels and significant placer gold resources could exist in concealed channels which have not yet been discovered.

MRZ-3a(p-15) - Buckeye/Chalk Bluff Ridge (placer gold): As indicated by limited exposures and isolated prospect workings located along mountain slopes, gold-bearing gravel deposits underlie Tertiary volcanic sediments that cap the western part of Chalk Bluff Ridge and Buckeye Ridge, which are located 6 miles west of Nevada City (Locality No. 371, Plates 4a, 4b). Extensive hydraulic mining removed most of the Tertiary gravel deposits from Buckeye Hill (Whitney, 1880) and the economic significance of the presumed deposits concealed by volcanic sediments of the Mehrten and Valley Springs formations has not been determined.

MRZ-3a(p-16) - Little York/Christmas Hill (placer gold): Gold-bearing gravel deposits exposed at these two localities, located 9 miles west-southwest of Grass Valley (Locality No. 378, Plate 4a/4b), were mined extensively by hydraulic methods prior to 1885 (Lindgren, 1911). It is not certain whether remaining resources would meet threshold value criteria established by the State Mining and Geology Board to be considered significant placer gold deposits under current economic conditions.

MRZ-3a(p-17) - Lowell Hill Ridge/Remington Hill (placer gold): Gold-bearing gravel deposits of unknown significance are likely to underlie Tertiary volcanic rocks capping Lowell Hill Ridge/Remington Hill (Plate 4b). Lindgren (1911) reports that only about 600,000 cubic yards of material exposed over a few acres remain on Remington Hill after about 1.75 million cubic yards were mined by hydraulic methods. The economic significance of other gold-bearing gravel deposits on Remington Hill that are interpreted by Lindgren (1911) to be concealed beneath the Tertiary volcanics has not been determined.

MRZ-3a(p-18) - Alpha Diggings (placer gold): Gold-bearing gravel deposits exposed over a 75-acre area were mined extensively at the Alpha hydraulic mine (Locality No. 388, Plate 4b) before the turn of the century. Lindgren (1911) reports that over 5 million cubic yards of material were removed with a little over 1 million cubic yards remaining. It is not certain whether remaining resources would meet threshold value criteria established by the State Mining and Geology Board (1983) to be considered a significant placer gold deposit under current economic conditions.

MRZ-3b(p-19) - Diamond Creek Diggings (placer gold): Gold-bearing gravel deposits have been extensively mined at the Diamond Creek Diggings (Locality No. 390, Plate 4b). The original deposit was described by Lindgren (1911) to have been only 12 feet thick and overlain by Pleistocene glacial moraine. The significance of placer gold resources likely to be concealed by glacial moraine overburden within this area has not been determined.

MRZ-3b(p-20) - Graniteville (placer gold): Gold-bearing gravel deposits located in the area of Graniteville have been extensively mined at the surface at the Alpha mine (Locality No. 383, Plate 4b). These ancient river channel deposits are interpreted by Lindgren (1911) to continue northeastward toward American Hill in Sierra County beneath volcanic-derived rocks of the Mehrten Formation (Figure 4). The economic significance of placer gold resources associated with remaining exposed Tertiary gravel and presumed concealed gravel deposits has not been determined.

MRZ-3b$^{(p-21)}$ - Snow Flower Mine (placer gold): A small exposure of fluvial sediments of probable Eocene age crops out about 3 miles north of Spaulding Lake. Although mined for placer gold in the past at the Snow Flower mine (Locality No. 402, Plate 4b), the extent of the deposit is unknown due to concealment by Pleistocene glacial outwash that covers many square miles of the surface in this region. The significance of this deposit as a placer gold resource area has not been determined.

AREAS CLASSIFIED FOR INDUSTRIAL MINERALS

Industrial minerals include earth materials that are of economic value, exclusive of metallic ores, fuels, and gemstones. Industrial minerals known to be or likely to be present in economic concentrations or grade in Nevada County include: barite; quartz cobbles for the production of silicon; kaolinite; asbestos; talc; illite; and carbonate rock. Construction aggregate, which is considered by many to be an industrial mineral, is addressed separately in Part IV.

BARITE RESOURCES

Barite (barium sulfate) is the most common barium mineral. Barite's principal industrial and pharmaceutical uses stem from its relatively high specific gravity (4.3-4.6) and its chemical inertness. The commodity is used primarily in well-drilling mud as a weighting agent, but is also processed for use in barium chemicals, pigments, glass, porcelain, paint and rubber filler, and as heavy concrete aggregate. Barite occurs as residual deposits derived from barite-bearing rocks, replacements of carbonate rock, fracture fillings (veins), and chemical sediment deposits formed by sea-floor hot spring activity. Two barite deposits, the Democrat and Spanish mines (Locality Nos. 2 and 3, Plate 5b), are interpreted in this report to be of the sea-floor hot spring exhalative type. A small vein-type occurrence of questionable economic interest is exposed on Pine Hill, located west of Higgins Corner (Locality No. 58, Plate 5a).

Areas Classified MRZ-2b$^{(i)}$ for Barite

MRZ-2b$^{(i-1)}$ - Upper Spanish Mine (barite): The Upper Spanish barite mine is located 3 miles north of Washington (Locality No. 2, Plate 5b). The deposit occurs within, and is interpreted to be genetically related to, a zone of sulfide mineralization enriched in base and precious metals mined at the Lower Spanish mine workings (MRZ-2a$^{(h-2)}$). The barite lens developed at this property measured up to 35 feet thick with a strike length of over 300 feet. It strikes N05° E and dips 35° E at the surface, steepening to 70° E at 300-foot depth. The lens is faulted out on the south side and pinches out on the north. The mine was first worked from 1930 to 1945, again in the mid-1950's, and was

worked last between 1981 and 1987. An estimated 200,000 tons of high-grade barite have been produced from the mine. The pit currently measures approximately 500 feet long, 200 feet wide, and 300 feet deep. Early underground mining reports indicate that the lens extends down at least another 200 feet, with an estimated 25,000 or more tons of barite remaining. However, overburden factors make additional mining of the lens uneconomic under current conditions. The pit is presently being back-filled to satisfy mined-land reclamation requirements. Demand for high-quality barite and changing economic conditions within the foreseeable future could spark renewed interest in mining the remaining resources.

MRZ-2b$^{(i-2)}$ - Democrat Mine (barite): The Democrat mine is located on Lowell Hill 3 miles northeast of Dutch Flat. Two en echelon barite lenses, one measuring about 30 feet thick and the other 7 feet thick, have been mined at this locality. The elongate bodies strike N05°W and dip 65°W. Production began in 1919 from a massive outcrop of coarsely crystalline barite that measured 250 feet long, 20 feet wide, and 60 feet high. About 35,000 tons of relatively high-grade barite (85-98 percent barium sulfate) are reported to have been produced prior to 1939 from pit and underground workings. Surface mine workings consist of a large open cut measuring about 200 feet long, 50 feet wide, and 30 feet deep. The amount and grade of unmined barite is unknown since no exploration drilling is known to have been done on the property. However, geophysical surveys conducted by the company that controls the property indicate that additional barite deposits exist as a series of small, isolated pods extending southwest from the two developed lenses. It is likely that other pods of barite occur northeast of the pit, concealed beneath the Tertiary volcanic rocks that cap Lowell Hill Ridge.

QUARTZ RESOURCES

Quartz, which also is referred to as silica, is used in a large variety of industrial applications, including the production of glass, silicon, stucco, filters, and abrasives. Important sources of quartz include quartzose sand and sandstone, gravel, quartzite, and vein quartz. Quartz sources normally must meet rigid chemical specifications depending on their end use, and have a higher unit value than common construction materials for which they are also suitable.

Areas Classified MRZ-2b$^{(i)}$ for Quartz

MRZ-2b$^{(i-3)}$ - Tertiary Gravel Deposits (quartz): The silicon industry has discovered that the quartz cobbles contained in or derived from the famous Tertiary gravel deposits of Nevada and neighboring counties are of suitable grade to produce silicon, an

elemental material critical in the manufacture of computer chips and other high-tech products. The high grade and abundance of quartz cobbles contained in the large volumes of Tertiary gravels present in Nevada County clearly make these deposits a significant mineral resource. Mining and separating of quartz for silicon production is currently taking place on San Juan Ridge at the N.C. Gravel pit and from the Placer Silica pit located on the Bear River (Locality Nos. 456 and 452, Plate 5a) and has previously taken place along Greenhorn Creek (Locality No. 451, Plate 5a). Areas classified MRZ-2a and MRZ-2b for placer gold are classified similarly for quartz since large volumes of reserves and/or inferred resources contained in these areas apply to quartz as well. In addition, the Placer Silica pit property and Greenhorn Creek, which have been classified MRZ-2 for aggregate (see MRZ-2a$^{(S\&G)\ A-2}$ and MRZ 2a$^{(S\&G)\ A-3}$), also are classified MRZ-2 for quartz.

Areas Classified MRZ-3a$^{(i)}$ for Quartz

MRZ-3a$^{(i-8)}$ - Tertiary Gravel Deposits (quartz): Areas classified MRZ-3a for placer gold resources are likewise classified MRZ-3a for quartz resources since the assignment of MRZ-3a to such areas generally reflects questionable volumes of material present.

CLAY RESOURCES

Clay is a natural, earthy, fine-grained material which has many important and vital industrial applications in our society. Nationally, clays rank among the leading industrial minerals in both tonnages produced and total value. There are six basic groups of clay generally recognized for industrial uses: kaolin, ball clay, fire clay, bentonite, fuller's earth, and common clay and shale. Each group has various properties and uses.

Most clay occurrences in Nevada County are associated with lateritic soil layers of early to middle Tertiary age (mainly Eocene) which have been preserved beneath younger sedimentary and volcanic deposits. These clay-bearing residual soils, which range between several feet to several tens of feet in thickness, were developed by chemical weathering processes during times when tropical and subtropical climates prevailed in this region. Clays formed by these processes are generally kaolinitic, but their overall composition and grade are dependent on parent rock-types and degree of weathering.

Areas Classified MRZ-3a$^{(i)}$ for Clay

MRZ-3a$^{(i-4)}$ - Central County Area (clay): A significant amount of clay is exposed in and around the numerous hydraulic mining pits present in Nevada County. Additional clay layers are preserved

beneath the Tertiary volcanic rocks (Mehrten and Valley Springs formations) that cap most of the major ridges of the central county area.

Limited physical and chemical analyses of clays sampled from several localities in Nevada County by Dietrich (1928) indicate that, in general, these clays lack characteristics necessary for use in the manufacture of quality ceramic and brick products. A single clay sample was collected during this study from a pre-Tertiary lateritic bedrock surface exposed at the bottom and adjacent to the Alpha hydraulic pit (No. 388, Plate 5b). The sample was identified by X-ray diffraction analysis as illite-quartz. Probable uses of these types of clays include lower grade inert carrier material used in products like insecticides and fertilizers, and impermeable lining material required at certain waste disposal, storage pond, and industrial sites.

Altered rhyolitic volcanic rocks of the Oligocene Valley Springs Formation, commonly referred to as "pipe clays," are sometimes found overlying the lateritic soils and/or Tertiary gravel deposits. Clay samples collected from one occurrence located at the Manzanita placer mine near Nevada City were physically and chemically analyzed and described by Dietrich (1928) as being of fair plasticity. A clay sample collected from the Manzanita mine during this study was identified through X-ray analysis as being sodium montmorillonite in composition. The clays occur as interbeds along the length of a 90-foot exposed sedimentary section. The individual clay and interbedded sandstone layers measure from 3 to 6 feet thick. X-ray analysis of similar altered rhyolitic clay beds overlying Tertiary gravel deposits exposed at the Omega Diggings identified the samples as having mixed compositions of kaolinite-smectite-illite-quartz and kaolinite-illite-quartz.

MRZ-3a$^{(i-5)}$ - Pine Hill (clay): This locality is situated about 3 miles northwest of Higgins Corner. Numerous stringers and discontinuous bodies of kaolinite clay are exposed on and around Pine Hill within intensely altered diabase. The alteration zone is mapped and described by Lindgren (1892) as measuring a mile-long by 1,000 to 2,000 feet wide, centered on Pine Hill. The zone is associated with a series of northerly striking quartz-barite-calcite-clay (quartz-illite) gouge veins enriched in base and precious metals (see MRZ-2b$^{(h-7)}$). The physical and chemical properties of several clay samples collected from Pine Hill were analyzed by Dietrich (1928) and found to be suitable for the manufacture of pottery, tile, and fire brick. Several clay samples were collected during the course of this study and through X-ray analysis were found to be composed chiefly of quartz and kaolinite. Although there appears to be a significant quantity of kaolinite on and adjacent to Pine Hill, the uniformity and distribution of commercial-grade clay within the alteration zone has not been determined.

CARBONATE ROCK RESOURCES

Carbonate rock, which includes limestone (calcium carbonate) and dolomite (calcium-magnesium carbonate), is used in the construction, agricultural, metallurgical, chemical, sugar refining, paint and glass manufacturing, and cement producing industries. By far the greatest volume of carbonate rock goes into the production of cement, which over many years has been one of California's leading nonfuel mineral commodities in dollar value.

Carbonate rock deposits of the Sierra Nevada are generally small, isolated lenses measuring less than a few thousand feet long and a few hundred feet wide. Several such deposits crop out in Nevada County, occurring in Triassic strata of the Clipper Gap Formation in the western part of the county, in Late Triassic-Early Jurassic strata of the Sailor Canyon Formation in the east-central part of the county, in late Paleozoic strata of the Calaveras Complex in the central part of the county, and in pre-Late Devonian strata of the Shoo Fly Complex in the east-central part of the county (plates 1a-c; 5a-c).

Areas Classified MRZ-3b$^{(i)}$ for Carbonate Rock

MRZ-3b $^{(i-6)}$ - Bowman Lake Limestone Deposits (carbonate rock): A series of unmined carbonate rock deposits crop out along a half-mile wide band extending north and south from Bowman Lake. Most of the individual lenses are only a few hundreds of feet long and less than 100 feet wide, but a few range up to one-half-mile long and 200 feet wide. Most, if not all these deposits are a mixture of relatively impure black to dark gray limestone and dolomite, with most deposits containing interbedded chert.

MRZ-3b $^{(i-7)}$ - New York Canyon Limestone Deposit (carbonate rock): Cropping out astride the South Fork of the Yuba River just east of New York Canyon (2 1/2 miles south of North Bloomfield; Plate 4a) is a 2,000-foot long, 100- to 200-foot thick, carbonate rock body. The northerly-trending, steeply east dipping lens is exposed over a vertical distance of 300 feet up the canyon walls above the river bed. The rock is blue-gray and black-mottled to black. The deposit has not been developed and no chemical analyses are available.

TALC/ASBESTOS RESOURCES

Talc is a magnesium-rich silicate mineral that, because of its softness, absorption, chemical inertness, and low conductivity, is used in many different applications by the paint, paper, ceramic, cosmetic, plastics, roofing, petroleum,

rubber, and chemical industries. Talc forms either through hydrothermal alteration of ultramafic rock or through metamorphism of dolomite or dolomitic carbonate rocks.

Asbestos is an industrial commodity term applied to several naturally fibrous minerals that are used in certain manufactured goods because of their fibrous and heat-resistant characteristics. The more common asbestos minerals include chrysotile, crocidolite, amosite, anthophyllite, tremolite, and actinolite. Almost all of the asbestos mined in California has been chrysotile (fibrous serpentine) or tremolite (fibrous amphibole) found in or near massive serpentinite bodies as veins or veinlets in parallel or network patterns. Most large masses of serpentinized ultramafic rock contain some asbestos, yet few deposits are of sufficient size or grade to be of economic interest.

Both talc and asbestos deposits occur in bodies of serpentinized ultramafic rocks. In Nevada County, most serpentinite rock bodies are exposed in four separate belts extending through Higgins Corner, the Nevada City-Grass Valley area, Chicago Park, and Washington (Plates 1a, 1b). Although production of talc has not been reported in Nevada County, the mineral has been produced from similar rocks elsewhere in the Sierra Nevada. Small tonnages of asbestos were mined in Nevada County from a single deposit located 2 1/2 miles northwest of Washington. This operation, the Sierra Asbestos mine (Locality No. 1, Plate 5b) produced short fiber chrysotile asbestos between 1917 and 1923.

Areas Classified MRZ-3a$^{(i)}$ for Talc and Asbestos

MRZ-3a$^{(i-9)}$ - Serpentinite (talc/asbestos): No known reserves or significant inferred resources of talc or asbestos occur in Nevada County. However, because both normally occur in bodies of serpentinite in quantities ranging from trace amounts to large concentrated volumes, significant exposures (greater than 1/4-square mile area) of serpentinite are classified MRZ-3a$^{(i-9)}$ for talc and asbestos resources.

AREAS CLASSIFIED FOR DEPOSITS FORMED BY MAGMATIC PROCESSES

CHROMITE RESOURCES

Magmatic ore deposits form when crystallization and differentiation of magmatic bodies result in concentrations of valuable minerals. The only mineral deposits of this type known to occur in the study area are concentrations of chromite.

Chromite ($Cr_2O \cdot FeO$) is the world's only economic source of chromium, an extremely hard, strong metal that is resistant to oxidation, corrosion, abrasion, chemical attack, and high temperature breakdown. Chromium is used for alloy (stainless steel), refractory (furnace lining), and chemical purposes. The commodity is a strategic mineral in short supply in the United States.

Chromite is hosted by ultramafic or serpentinized ultramafic rocks in massive and disseminated form. In the alpine-type ultramafic rocks present in the Sierra Nevada, the deposits typically occur as small pods measuring from a few feet to tens of feet long. Nearly every ultramafic rock belt contains economic concentrations of chromite somewhere along its length (Stanton, 1972). Most ultramafic rocks in Nevada County have been altered to serpentinites that are exposed in four separate belts extending through Higgins Corner, the Nevada City-Grass Valley area, Chicago Park, and Washington (Plates 1a, 1b).

About 6,000 tons of chromite have been mined from some 40 chromite localities in Nevada County. One mine, the Red Ledge (Locality No. 38, Plate 5b), produced 25 percent of the total, and four others, the Sweet Ranch, Rapid Fire, Porter, and Holseman mines (Locality Nos. 28, 37, 4, and 8, Plates 5a, 5b), produced 50 percent of the total. Six other mines, the Alta Hill, Half Chrome, Moscatelli, Victory, Sherman Ranch, and Waite (Locality Nos. 9, 29, 35, 39, 403, and 404, Plates 5a and 5b) produced over 100 long tons each. The rest of the chromite localities plotted on Plates 5a and 5b and listed in Appendix A produced between 2 and 60 long tons each (Rynearson, 1953). All but about 150 tons of the total chromite production was produced before 1920 and many mines show only 1 or 2 years' production, indicating that known deposits generally were small and worked out.

Areas Classified MRZ-3a$^{(m)}$ for Chromite

MRZ-3a$^{(m-1)}$ - Serpentinite (chromite): Chromite localities occur in each of the four serpentinite belts extending through Nevada County. However, no known significant reserves or inferred resources of chromite exist. Although the known deposits of the region are typically small, exploration could result in discovery of blind ore bodies of economic interest. Consequently, all significant exposures (greater than one-fourth square mile) of serpentinite are classified MRZ-3a$^{(m-1)}$ for deposits formed by magmatic segregation.

PART IV - MINERAL LAND CLASSIFICATION,

CONSTRUCTION AGGREGATE RESOURCES

Sand, gravel and crushed stone are "construction materials." These commodities, collectively called "aggregate" or "construction aggregate," provide bulk and strength to portland cement concrete, asphaltic concrete, plaster, and stucco. Aggregate is also used as road base, subbase, railroad ballast and fill. Aggregate normally provides 80 to 100 percent of the material volume in these uses.

Large quantities of aggregate are consumed by the building and paving industries and future demand for this commodity is expected to increase throughout California. Aggregate materials are essential to modern society, both to maintain the existing infrastructure and to provide for new construction. Therefore, aggregate materials are a resource of great importance to the economy of any developing area. Because aggregate is a low unit-value, high bulk-weight commodity, it must be obtained from nearby sources to minimize costs to the aggregate consumer. If nearby sources do not exist, then transportation costs can quickly exceed the value of the aggregate. In addition to increasing the cost of aggregate to the consumer, transporting aggregate from distant sources also results in increased fuel consumption, air pollution, traffic congestion, and road maintenance. Transportation cost is the principal constraint defining the market area for an aggregate operation. These factors set construction aggregate apart from many other mineral commodities, such as gold or copper, that may reach markets far removed from the areas in which they are mined.

TRANSPORTATION RATES

All aggregate marketed in Nevada County is transported by truck. Minimum rates for independent aggregate truckers are set by the California Public Utilities Commission (PUC). Rates for Nevada County are published in "Minimum Rate Tariff 7-A," Sections 2 and 3. Charges are calculated based on either an hourly rate (Table 1) or a distance rate (Table 2). The minimum hourly rate or the minimum distance rate, whichever is larger, may be charged to the consumer. If the hourly rate is used, the carrier and debtor must enter into a written agreement prior to transport.

Table 2 illustrates how the PUC rates increase with distance as specified in Minimum Rate Tariff 7-A. For example, hauling aggregate from the Greenhorn Creek area to Grass Valley (approximately 11 miles) results in a minimum additional cost of

$1.72 per ton over the cost of the same material purchased at the mine site (average $5.00 per ton). To haul aggregate to Grass Valley in western Nevada County from the Martis Valley production area in eastern Nevada County (approximately 55 miles) would increase the cost by a minimum of $6.13 per ton to $11.13 per ton, more than doubling the cost and demonstrating the economic importance of maintaining accessible local sources.

CLASSIFICATION PROCEDURES

Classification procedures and categories are identical to those previously described for other mineral commodities. To determine the significance of a construction aggregate deposit and whether the land containing that deposit should be classified MRZ-2, SMARA uses two criteria:

1) The deposit must be composed of material of suitable quality to be considered a marketable commodity.

2) The deposit must meet threshold value. The projected value (gross selling price) of the deposit, based upon the value of the first marketable product, must be at least 5,000,000 1978 dollars (approximately 9,700,000 1989 dollars).

Suitability as a marketable commodity is demonstrated by current or past commercial or government production of construction aggregate from a deposit, or by the existence of aggregate quality tests that indicate the material in the deposit is likely to meet California Department of Transportation specifications for a specified class of construction aggregate.

Rarely is in-place aggregate (raw material) physically or chemically suited for every type of aggregate use. Every potential deposit must be tested to determine how much material can meet specifications for a particular use, and what processing is required. Specifications for aggregate have been established by federal, state and local agencies to ensure the manufacture of strong, durable structures capable of withstanding the physical and chemical effects of weathering and use. These agencies, and other major consumers of aggregate, test aggregate by standard test procedures defined by such organizations as the American Society for Testing Materials (ASTM), the American Association of State Highway Officials (AASHO), and the California Department of Transportation (Caltrans). These tests determine the physical

Table 1. Minimum hourly rates for transport of aggregate in the Nevada County area. From California Public Utilities Commission, 1987. Minimum Rate Tariff 7-A (current rates as of July 1, 1989).

TYPICAL TONS PER LOAD	NO. OF AXLES PER UNIT OF EQUIPMENT	*HOURLY RATES ($)	$/TON/HR
10	2	40.66	4.07
15	3	46.01	3.07
24	4	47.62	1.98
26	5+	51.31	1.97

*Rates are higher on holidays and weekends.

Table 2. Minimum distance rates for transport of aggregate in Nevada County. From California Public Utilities Commission, 1987, Minimum Rate Tariff 7-A (current rates as of July 1, 1989. Includes surcharge as specified in Supplement 29).

MILES		RATES*	MILES		RATES*
OVER	BUT NOT OVER	$/TON	OVER	BUT NOT OVER	$/TON
0	1	0.58	35	36	4.23
1	2	0.69	36	37	4.32
2	3	0.81	37	38	4.43
3	4	0.92	38	39	4.52
4	5	1.03	39	40	4.61
5	6	1.15	40	41	4.70
6	7	1.26	41	42	4.81
7	8	1.37	42	43	4.91
8	9	1.49	43	44	5.00
9	10	1.60	44	45	5.09
10	11	1.72	45	46	5.19
11	12	1.82	46	47	5.29
12	13	1.93	47	48	5.38
13	14	2.03	48	49	5.49
14	15	2.15	49	50	5.59
15	16	2.24			
16	17	2.35	50	52	5.77
17	18	2.44	52	54	5.94
18	19	2.54	54	56	6.13
19	20	2.66	56	58	6.31
20	21	2.75	58	60	6.49
21	22	2.85			
22	23	2.95	60	63	6.70
23	24	3.05	63	66	6.99
24	25	3.16	66	69	7.27
25	26	3.26	69	72	7.56
26	27	3.36	72	75	7.84
27	28	3.46			
28	29	3.56	75	80	8.27
29	30	3.64	80	85	8.69
30	31	3.74	85	90	9.13
31	32	3.84	90	95	9.57
32	33	3.94	95	100	10.00
33	34	4.06			
34	35	4.12			

* Rates are higher for holidays and weekends and if equipment other than "a tractor with bottom dump doubles in train" are required at the destination.

and chemical properties of the materials and also aggregate size and shape. Aggregate for uses such as portland cement concrete or asphaltic concrete must meet more specifications than aggregate for uses such as base or subbase.

In Nevada County, construction aggregate sells in bulk for an average price of about $5.00 per ton ($3.00 to $7.00 per ton) at the production site. At this average price, a deposit must contain a minimum of 1.94 million tons of aggregate to meet the threshold value established by the State Mining and Geology Board.

CLASSIFICATION OF CONSTRUCTION AGGREGATE

Nevada County has been classified for the presence or likely occurrence of construction aggregate resources, which can be either crushed stone resources or sand and gravel resources. Each of these commodities has been further subdivided by its geologic environment.

Crushed stone resources have been divided into the following three classes:

1. Metamorphic rocks
2. Volcanic igneous rocks
3. Plutonic igneous rocks

Sand and gravel resources have been divided into two classes:

1. Alluvial deposits
2. Glacial deposits

It is hoped that these divisions will help both the local government in making planning decisions and the aggregate industry in seeking additional sources of aggregate materials suitable for their needs.

Following are the descriptions of the areas classified MRZ-2 and MRZ-3 for the above types of construction aggregate resources. Information on government borrow sites and potential borrow sites was collected from the files of the California Department of Transportation and the U.S. Forest Service.

AREAS CLASSIFIED FOR CRUSHED STONE RESOURCES

Areas classified for crushed stone resources in Nevada County are shown on Plates 6a-c. The classified areas are identified by the following superscripts; $(CS)^{M}$ (crushed stone - metamorphic rocks), $(CS)^{V}$ (crushed stone - volcanic igneous rocks) or $(CS)^{I}$ (crushed stone - plutonic igneous rocks). Additionally, superscript reference numbers are used to identify specific MRZ-2a, MRZ-2b, and MRZ-3a deposits discussed in this

section. Deposits of a given classification and type, for example MRZ-2a $(CS)^{M}$, are generally numbered from west to east across the county.

AREAS IDENTIFIED $(CS)^{M}$:

Areas identified $(CS)^{M}$ contain crushed stone resources consisting of metamorphic rocks. These rocks occur predominantly in the western and central portions of the county and consist of weakly to strongly metamorphosed sedimentary, volcanic, and plutonic rocks ranging in age from early Paleozoic to Jurassic. Metamorphic rocks can be suitable for a variety of construction aggregate uses, up to and including aggregate for use in portland cement concrete; however, the textural and chemical variability of some metamorphic rocks may render them less desirable or unsuitable for some construction aggregate uses.

In western Nevada County aggregate for a variety of uses, including portland cement concrete-grade aggregate, is produced from some of the metavolcanic rocks of the Lake Combie Complex. Similarly, the Smartville Complex is also predominantly metavolcanic in nature and might be host to similar deposits. Many of the other metamorphic units in the county (see geologic map, Plate 1), such as the Clipper Gap, Reeve, Peale, Sierra Buttes, and Grizzly formations, the Calaveras and Shoo Fly complexes, and melange units are predominantly metasedimentary and contain slates, argillites, and phyllites that have well-developed textures that could render them unsuitable for use in portland cement concrete or asphaltic concrete. However, they could possibly prove suitable for use as road base or subbase.

Base materials are currently produced from one serpentinite deposit in western Nevada County. Serpentinite and serpentinized igneous waste rock from gold mines and tunnels in Nevada County have been used for subbase and base material in the past by both commercial and government agencies. This indicates the potential suitability of serpentinite bodies exposed elsewhere in the county.

Areas Classified MRZ-2a $(CS)^{M}$:

MRZ-2a $(CS)^{M-1}$ - Lake Combie Area: This property was previously classified MRZ-2 for crushed stone resources by the Division of Mines and Geology (Dupras, 1983) and this classification has not been altered in the current report. The area classified is located near the northern end of Lake Combie along the border between Nevada and Placer counties. The materials involved are metamorphosed volcanic and volcaniclastic rocks of the Jurassic Lake Combie Complex. The property is owned or controlled by the Joe Chevreaux Company, which has been marketing crushed stone from this operation since the late 1960's. The major parts of this operation are located on the Placer County portion of the property. Crushed stone from this operation has been marketed

for several construction aggregate uses including portland cement concrete, asphaltic concrete, road base, and railroad ballast.

MRZ-2a (CS)$^{M-2}$ - Grass Valley Area: This area lies just outside of Grass Valley off Idaho-Maryland Road. The area is underlain by serpentinite and serpentinized ultramafic rocks. North Star Rock Products, Inc. is currently quarrying serpentinite and serpentinized ultramafic rocks for use as base material at the site. Prior to the quarry operation, North Star Rock Products, Inc. had produced crushed stone at the site using waste rock from the Idaho-Maryland mine.

Areas Classified MRZ-3a (CS)^{M}:

MRZ-3a (CS)$^{M-3}$ - Lake Combie Area: This area lies north of Lake Combie and adjacent to the northern portion of the MRZ-2a deposit controlled by the Joe Chevreaux Company. The area is underlain by metamorphosed volcanic and volcaniclastic rocks similar to those on the Chevreaux property. Deposits in this area are potential sources of crushed stone; however, further evaluation of these deposits on a site-specific basis would be required to establish material quality and quantity.

MRZ-3a (CS)$^{M-4}$ - Grass Valley Area: This area lies east and north of Grass Valley and is underlain by serpentinite and serpentinized ultramafic rocks. These rocks are similar to those that North Star Rock Products, Inc. mined in the portion of the area classified MRZ-2a; however, further testing and evaluation would be required to assess the suitability of these deposits as sources of crushed stone.

MRZ-3a (CS)$^{M-5}$ - Taylor Crossing Area: This area lies northwest of Colfax near Taylor Crossing on the Bear River in Nevada and Placer counties. The area is underlain by metavolcanic rocks of the Lake Combie Complex and metasedimentary rocks of the Clipper Gap Formation (see geologic map, Plate 1). Crushed stone from this deposit has been mined by Hansen Brothers Enterprises and blended with sand and gravel from the Bear River, which runs through the property. The blended material has been marketed for use as base material. Since crushed stone from this site has been marketed for use as base material in a blended product it seems likely that a pure crushed stone product could also be suitable for use as base or subbase. However, since no tests establishing the quality of the pure crushed stone resource were available, the site is classified MRZ-3a for crushed stone resources.

MRZ-3a (CS)$^{M-6}$ - Greenhorn Creek Area: This area is located along Greenhorn Creek upstream of Rollins Reservoir and adjacent to the plant area of Hansen Brothers Enterprises on Greenhorn Creek. The area is underlain by metasedimentary and metavolcanic rocks of the Clipper Gap Formation and Shoo Fly Complex. Hansen Brothers Enterprises has used some of this material to blend with alluvial material from Greenhorn Creek to make base and subbase.

Since the quality of the crushed stone resource has not been demonstrated independently of the sand and gravel resource, the area is classified MRZ-3a.

MRZ-3a (CS)$^{M-7}$ - Washington Road Area: This area lies approximately 1.5 miles north of Junction House on the road to Washington. The area is underlain by serpentinite and serpentinized ultramafic rocks. This material has been used by the U.S. Forest Service and possibly others for road construction and maintenance. Past removal of material is evident on both sides of Washington Road. The site is classified MRZ-3a because of lack of information about the volume of materials present and lack of definitive test data.

Areas Classified MRZ-3b (CS)^{M}:

Areas classified MRZ-3b(CS)^{M} indicate areas underlain by bodies of metamorphic rocks that represent a favorable geologic environment in which deposits of material suitable for use as crushed stone may occur, but for which site-specific quality and/or quantity information is lacking or insufficient. These 37 areas occur throughout western and central Nevada County. Testing and evaluation would be required on a site-specific basis to assess the suitability of these deposits for commercial sources of crushed stone for use as construction aggregate.

AREAS IDENTIFIED (CS)^{V}:

Areas identified (CS)^{V} contain crushed stone resources consisting of volcanic igneous rocks. These rocks occur in the eastern and central portions of Nevada County and consist of andesitic and basaltic flows, intrusions, pyroclastic deposits, and cinder cones of Mio-Pliocene, Pliocene, and Quaternary ages (see geologic map, Plate 1). There is currently one commercial crushed stone operation producing volcanic cinders for use as road base in eastern Nevada County. Commercial production of volcanic cinders has occurred at other deposits in eastern Nevada County in the past. Crushed stone produced from basaltic rocks in the eastern part of the county has been used as riprap in the construction of dams in the area and volcanic materials may have been used by the U.S. Forest Service or other government agencies on a noncommercial basis in the past. In many areas of California, volcanic rocks are mined for use as crushed stone and have proven suitable for a variety of aggregate uses including portland cement concrete and asphaltic concrete. Many of the andesitic and basaltic flows of eastern Nevada County are potential resources of construction aggregate; however, such deposits would have to be evaluated on a site-specific basis to determine material quality and establish economic threshold.

Areas Classified MRZ-2a (CS)^{V}:

MRZ-2a (CS)$^{V-1}$ - Juniper Flat Area: This property is in eastern Nevada County approximately 5 miles northeast of Truckee. The deposit consists of a Quaternary volcanic cinder cone that is rimmed by Quaternary basalts. Sha-Neva, Inc. has been quarrying volcanic cinders since 1968 on a portion of the property that it controls. The cinders produced by this operation are marketed for a variety of uses including road base; drain, filter, and decorative rock; as well as backfill, bedding, and highway sands.

Areas Classified MRZ-3a (CS)^{V}

MRZ-3a (CS)$^{V-2}$ - Hirschdale Area: This deposit is near Cox-Delaney Flat in eastern Nevada County approximately 7 miles northeast of Truckee. The area is underlain by red and black volcanic cinders and some basalts and tuffs. The site was previously mined by West River, Inc., which marketed the cinders for road base and decorative rock. Although the previous mining of the site indicates that the materials present are suitable for use as construction aggregate, it is not known if the volume of materials remaining is sufficient to meet threshold value.

MRZ-3a (CS)$^{V-3}$ - Truckee Area: This area lies just north of the Town of Truckee in eastern Nevada County. The deposit consists of a Quaternary volcanic cinder cone composed of red and black volcanic cinders. This site was formerly mined by Sha-Neva, Inc. and is classified MRZ-3a because of lack of information about the volume of materials remaining.

Areas Classified MRZ-3b (CS)^{V}:

Areas classified MRZ-3b(CS)^{V} indicate bodies of volcanic igneous rocks for which no conclusive information indicating commercial potential was found. These 23 areas, which occur mostly in the eastern and central portions of Nevada County, represent a favorable geologic environment in which deposits of crushed stone suitable for use as construction aggregate may occur. However, further testing and evaluation would be required on a site-specific basis to assess the suitability of these deposits as commercial sources of crushed stone.

AREAS IDENTIFIED (CS)^{I}:

Areas identified (CS)^{I} contain crushed stone resources consisting of plutonic igneous rocks. In the western portion of the county, these rocks include Cretaceous and Jurassic plutonic rocks ranging from granitic to gabbroic in composition (see geologic map, Plate 1). In the central and eastern parts of the county, the plutonic rocks include Cretaceous rocks ranging from granites to diorites and late Devonian rocks of the Bowman Lake batholith that includes granites, granodiorites, trondhjemites, and tonalites. There is no current commercial production of

crushed stone from plutonic igneous rocks in Nevada County. In the past, waste rock from the underground mines and tunnels in the county has been used by various agencies such as Caltrans and the U.S. Forest Service for the construction and maintenance of roads. Much of this waste rock was plutonic, and this use demonstrates the potential suitability of this material as construction aggregate. In many areas of the United States, plutonic rocks are mined for use as crushed stone and have been proven suitable for use in a variety of aggregate products up to and including portland cement concrete. Many of the plutonic rocks of Nevada County could prove suitable for use as construction aggregate; however, further evaluation of these deposits on a site-specific basis would be required to establish material quality and quantity.

Areas Classified MRZ-3a (CS)^{I}:

MRZ-3a (CS)$^{I-1}$ - Greenhorn Creek Area: This area is located along Greenhorn Creek upstream of Rollins Reservoir and adjacent to the plant area of Hansen Brothers Enterprises on Greenhorn Creek. The area is underlain by diabasic igneous rocks. Hansen Brothers Enterprises has used some of this material to blend with alluvial material from Greenhorn Creek to make base and subbase. Since the quality of the crushed stone resource has not been demonstrated independently of the sand and gravel resource, the area is classified MRZ-3a.

Areas Classified MRZ-3b (CS)^{I}:

Areas classified MRZ-3b^{I} indicate bodies of plutonic igneous rocks for which no conclusive information indicating commercial potential was found. These 41 areas, which occur throughout Nevada County, represent a favorable geologic environment in which deposits of material suitable for use as crushed stone may occur. Further information about either material quality and/or quantity would be required to assess the suitability of individual deposits as sources of construction aggregate.

AREAS CLASSIFIED FOR SAND AND GRAVEL RESOURCES

Areas classified for sand and gravel resources in Nevada County are shown on Plates 6a-c. The classified areas are identified by the following superscripts, (S&G)^{A} (sand and gravel - alluvial) or (S&G)^{G} (sand and gravel - glacial). Superscript reference numbers are used to identify specific MRZ-2a, MRZ-2b, and MRZ-3a deposits discussed in this section. Deposits of a given classification and type, for example MRZ-2a (S&G)^{A}, are generally numbered from west to east across the county.

AREAS IDENTIFIED (S&G)[A]:

Areas identified as (S&G)[A] contain sand and gravel resources of alluvial origin. Alluvial deposits are those that have been transported and deposited by moving water. Alluvial transport generally sorts materials by size and removes soft or mechanically unstable components and fines. In Nevada County these deposits include recent alluvial deposits of sand and gravel in the rivers and creeks of the county, as well as older alluvial deposits.

Currently most of the sand and gravel produced in the western portions of Nevada County is mined from recent deposits on the Bear River and on Greenhorn Creek. Material from these deposits has been proven suitable for a variety of uses, including portland cement concrete and asphaltic concrete. These deposits contain a high percentage of quartz cobbles that contribute to the durable nature of this material and make these deposits a potential source of raw materials for the production of silicon. Materials from some of these deposits have also been marketed for specialty uses such as decorative rock, filter media, and abrasives. The sources of the materials that make up these recent deposits are, in large part, the older Tertiary gravels and the debris from the hydraulic mining of these gravels for gold near the turn of the century. Transport in modern rivers and creeks has sorted and cleaned these materials, resulting in high-quality deposits that require less processing than in-situ Tertiary gravels. This makes these recent alluvial deposits more economical to mine and process than the Tertiary gravels from which they were derived.

Included in the older alluvial deposits are the Tertiary gold-bearing gravels that occur in western Nevada County and the western parts of central Nevada County. These materials were deposited by the ancestral Yuba River system and were mined extensively by hydraulic methods for their gold content in the late 1800's. Although these deposits have historically been called "gravels," they actually contain large amounts of sand, silt, and clay in addition to the gravel- to boulder-size materials. Compositionally, these gravels are made up of metamorphic, igneous, and quartz cobbles. The Tertiary gravels can be differentiated from the more recent gravel deposits by the presence of unmetamorphosed volcanic clasts in the more recent gravels (Yeend, 1974). In Yuba County, base and subbase materials are produced from deposits of Tertiary gravels near Smartville. Many areas containing Tertiary gravels or the debris remaining from the hydraulic mining of such deposits are classified MRZ-2b for construction aggregate in this report and would be likely sources of subbase and/or base materials. Since the Tertiary gravels and hydraulic debris are the source of materials for the high-quality aggregate deposits in the Bear River and Greenhorn Creek, it is possible that, with sufficient processing, portions of some of these deposits could also produce aggregate for use in portland cement concrete or asphaltic

concrete. However, the economics of processing these deposits to produce such products would have to be evaluated on a site-specific basis.

Also included in the older alluvial deposits are the rocks of the Mehrten and Valley Springs formations in the western and central parts of the county. These volcanic-sedimentary units are included here because of the abundance of mudflows, breccias, volcanic sediments, and conglomerates in these formations in the western and central parts of the county. No commercial production of construction aggregate from these formations occurs in Nevada County and it is unlikely that material from these formations could be used for portland cement concrete or asphaltic concrete; however, exploration and testing might find areas in these formations suitable for use as subbase or base materials.

In the eastern part of the county the older alluvial deposits include older stream and terrace deposits. These deposits are similar to recent alluvial deposits in eastern Nevada County but are older and therefore may be more weathered. This weathering, if present, commonly decreases the physical strength of the clasts and may make the material suitable only for uses in which high physical strength and durability are not specified. If weathering is severe enough, the material may be rendered unsuitable for use as construction aggregate. No current production of aggregate occurs from these units. However, old borrow pits exist in some of these formations, indicating the materials have been used for construction aggregate in the past. Testing would be required to determine the highest use for which these materials would be suitable.

Areas Classified MRZ-2a (S&G)^{A}

MRZ-2a (S&G)$^{A-1}$ - Bear River/Lake Combie Area: This property was previously classified MRZ-2 for sand and gravel resources by the Division of Mines and Geology (DMG OFR 83-28 SAC, 1983) and this classification has not been altered in this report. The area classified includes Lake Combie and a portion of the Bear River above Lake Combie along the border between Nevada and Placer counties. Mining has been conducted at this site since 1946. The Joe Chevreaux Company currently mines this deposit and produces construction aggregate for a variety of uses up to and including portland cement concrete. Additionally a variety of specialty products are mined and marketed from this deposit including engine, refractory, abrasive, and filtration sands. The aggregate processing operation is in Placer County. The deposit consists of recent alluvial materials derived from deposits of older Tertiary gravels and hydraulic mine tailings located upstream.

MRZ-2a (S&G)$^{A-2}$ - Bear River/Steephollow Creek Area: The area classified includes the portion of the Bear River from the Dutch Flat area downstream to the inlet of Rollins Reservoir and Steephollow Creek from Steephollow Crossing to the Bear River.

The deposit consists of gravels, sands, and silts derived from nearby deposits of Tertiary gravels and hydraulic mining debris. The R.J. Miles Company has been mining from a portion of this deposit since 1965 and produces aggregate for a variety of uses including portland cement concrete and road base. Quartz cobbles used in the manufacture of silicon are also currently produced from this deposit.

MRZ-2a (S&G)[A-3] - Greenhorn Creek Area: The area classified includes the portion of Greenhorn Creek from the Gas Canyon area down to the upper reaches of Rollins Reservoir. The deposit consists of gravels, sands, and silts derived from nearby deposits of Tertiary gravels and hydraulic mining debris. Hansen Brothers Enterprises has mined aggregate from a portion of this deposit since 1973 and produces aggregate for a variety of uses including portland cement concrete, asphaltic concrete, road base, and subbase. The upper portions of this deposit adjacent to Buckeye Ridge have been tested, and possibly used, in the past by Caltrans and the U.S. Forest Service.

MRZ-2a (S&G)[A-4] - Trood Placer Mine Area: The area classified lies approximately 1.5 miles southeast of the town of North Columbia. The deposit is part of the much larger San Juan Ridge West area (see MRZ-2b (S&G)[A-12]). The area is covered by hydraulic mining debris and unmined Tertiary gravel deposits. The hydraulic debris consists of quartzose sands and gravels with few fines. The Tertiary deposits contain quartzose sands and gravels and may contain significant amounts of clay in places. Mining has been conducted at this site by various operators for the last 30 years. For the last 11 years, aggregate has been produced for use as portland cement concrete, base, and road sand. The site is currently operated by Desert Gold, Inc. / N.C. Gravel. Quartz cobbles used in the manufacture of silicon and construction aggregate are produced from this deposit.

Areas Classified MRZ-2b (S&G)[A]:

MRZ-2b (S&G)[A-5] - Mooney Flat Area: This area was previously classified MRZ-2 for base resources by the Division of Mines and Geology (DMG SR 132, 1988) and that classification has not been altered in this study. Test data indicated that the materials were suitable for use as subbase or base and, at that time, two operators were producing base materials from the same geologic unit just across the Nevada County line in Yuba County. The deposit consists of gravels, sands, and silts that were deposited by the ancestral Yuba River system. At the time of the previous classification, a mining operation at this location in Nevada County was proposed; however, the proposed operation has not been established and no aggregate mining has taken place.

MRZ-2b (S&G)[A-6] - Deer Creek Area: The area classified lies just southwest of Nevada City. The deposit consists of dredge tailings and recent alluvium in the channel of Deer Creek. The gravel fraction of the deposit consists predominantly of granitic and metamorphic clasts. The material has been tested by Caltrans

and was used in the construction of the Golden Center Freeway (State Highway 49). Tests indicate that the material is suitable for subbase and base, but further testing would be necessary to find out if the materials are suitable for other uses such as portland cement concrete or asphaltic concrete.

MRZ-2b (S&G)$^{A-7}$ - Shady Creek Area: The area classified lies southwest of North Columbia. The deposit consists of dredge tailings and recent alluvium in the channel of Shady Creek, which drains the old hydraulic mines and Tertiary gravel deposits of San Juan Ridge. The deposit contains quartzose sands, gravels and silts. A limited number of Caltrans tests indicate that the materials could be suitable for subbase and base material. Further testing could prove the material suitable for other uses such as portland cement concrete or asphaltic concrete.

MRZ-2b (S&G)$^{A-8}$ - Bear River Area: The area classified extends downstream from Rollins Reservoir to the Joe Chevreaux property at Lake Combie. The deposit consists of recent alluvium in the channel of the Bear River. This deposit has been mined in the past by several operators for aggregate for a variety of uses, including portland cement concrete and asphaltic concrete. However, since the construction of the Rollins Reservoir Dam in the mid-1960's, aggregate has been retained behind the dam and recharge of aggregate to this portion of the Bear River has ceased. Although this section of the Bear River probably exceeds the threshold value of aggregate necessary to be classified MRZ-2, it is unlikely that the remaining scattered deposits are localized enough to allow economic extraction of the resource.

MRZ-2b (S&G)$^{A-9}$, (S&G)$^{A-10}$, and, (S&G)$^{A-11}$ - North San Juan/French Corral Area: This group of deposits is made up of three hydraulic mine pits and associated bodies of unmined Tertiary gravels extending from North San Juan to French Corral. These areas were heavily mined for gold in the late 1800's and only in the area between Birchvale and French Corral do large amounts of unmined Tertiary gravels remain. The gravels in this area contain less quartz and more metamorphic clasts than those in other parts of Nevada County and therefore may not be suitable for some uses such as portland cement concrete or asphaltic concrete.

MRZ-2b (S&G)$^{A-12}$ - San Juan Ridge West Area: The area classified is in northern Nevada County along San Juan Ridge. The deposit consists of unmined Tertiary gravels and hydraulic mining debris. Desert Gold, Inc. / N.C. Gravel currently mines construction aggregate and quartz for the manufacture of silicon on a small portion of this deposit previously identified as the Trood Placer mine (MRZ-2a (S&G)$^{A-4}$). This deposit is one of the largest deposits of Tertiary gravels in Nevada County. The deposit is over 4 miles long and exploratory drilling for gold has indicated that the deposit may be up to a mile wide and 600 feet deep in places.

MRZ-2b (S&G)[A-13] - Malakoff Diggings Area: The area classified is in the northern part of the county along San Juan Ridge. The deposit consists of unmined Tertiary gravels and hydraulic mining debris. This deposit contains large amounts of material; however, much of the potential resource at this site is encompassed by the Malakoff Diggings State Park and it is highly unlikely that the portions of the deposit within the park will be mined.

MRZ-2b (S&G)[A-14] - Sailor Flat/Blue Tent Area: The deposit consists of unmined Tertiary gravels and hydraulic mining debris. The site has been previously mined for gold. Material from this site has been tested and may have been used by Caltrans for subbase and base. The volume of material here is small compared to some of the other Tertiary gravel deposits in Nevada County but exceeds the threshold required for MRZ-2 classification.

MRZ-2b (S&G)[A-15], (S&G)[A-16], (S&G)[A-17], and (S&G)[A-18] - Scotts Flat/Little York Area: This group of four deposits is composed of unmined Tertiary gravels and old hydraulic mine pits trending northwest from Little York Diggings to Scotts Flat. The deposits consist of hydraulic mining debris and unmined Tertiary gravels, sands, and silts. The volume of material in each of these areas varies from small to large, but each exceeds the threshold required for MRZ-2 classification.

MRZ-2b (S&G)[A-19] - Liberty Hill Diggings/Lowell Hill Area: The area classified is northeast of Dutch Flat. The deposit consists of hydraulic mining debris and unmined Tertiary gravels, sands, and silts similar to other such deposits in Nevada County.

MRZ-2b (S&G)[A-20] - Omega Diggings Area: The deposit consists of hydraulic mining debris and unmined Tertiary gravels, sands, and silts at the site of the old Omega Diggings in central Nevada County. This deposit is the easternmost deposit of Tertiary gravels in Nevada County and is similar in composition and character to other deposits of Tertiary gravels in Nevada County.

Areas Classified MRZ-3a (S&G)[A]:

MRZ-3a (S&G)[A-21] - Penn Valley Area: The area classified contains alluvial sediments transported into Penn Valley by Squirrel and Clear creeks and other smaller drainages. Mining of aggregate has occurred at two sites along Squirrel Creek in the past. The first site is in the northeast portion of Penn Valley. There is evidence of past mining at this site, although it is not known if the operation was commercial or governmental. The few Caltrans tests available indicate that the material is suitable for use as base. The second site, near Western Gateway Regional Park, was operated as a small commercial source for drain rock and base in the past, but the volume of material remaining is unlikely to meet threshold. The alluvial deposits of Penn Valley represent a favorable geologic environment for the occurrence of sand and gravel deposits, particularly along Squirrel and Clear creeks.

MRZ-3a (S&G)$^{A-22}$ - Jordan Creek Area: This deposit consists of sand and gravel in the channel of Jordan Creek near Lake Spaulding in central Nevada County. Caltrans tests indicate that the materials are suitable for use as subbase and base and possibly other uses. Some evidence of past mining is apparent at this site; however, it is unknown whether the volume of material present is sufficient to meet threshold.

MRZ-3a (S&G)$^{A-23}$ - Rattlesnake Creek Area: The deposit consists of alluvial materials in the channel of Rattlesnake Creek northeast of Cisco Grove in central Nevada County. Limited test data indicate that the materials could be used for subbase and base and possibly higher uses. It is not known whether the volume of material present in this deposit is sufficient to meet threshold.

MRZ-3a (S&G)$^{A-24}$ - Prosser Creek Area: This area lies north of Prosser Reservoir and is underlain by older alluvial deposits. The deposit consists of gravels, sands, and silts. The larger size fraction is composed of volcanic and igneous clasts. Two borrow pits exist in this unit and it is likely that materials from these sites were used for the construction of the relocated Highway 89 when Prosser Dam was built or in the construction of the dam itself. The limited test data available indicate that the material could be suitable for use as road base, but were not adequate for an MRZ-2b classification.

MRZ-3a (S&G)$^{A-25}$ through (S&G)$^{A-42}$ - Miscellaneous Deposits: This group of deposits, which occur throughout western and west central Nevada County, consists of small hydraulic mine pits and/or bodies of unmined Tertiary gravels. These deposits are similar to those deposits of Tertiary gravel and hydraulic mining debris classified MRZ-2b; however, it is not known if these deposits contain enough material to meet the threshold required for MRZ-2 classification.

Areas Classified MRZ-3b (S&G)^{A}:

Areas classified MRZ-3b(S&G)^{A} indicate sand and gravel deposits of alluvial origin for which no conclusive information indicating commercial potential was found. These 78 deposits, which occur throughout Nevada County, represent a favorable geologic environment in which sand and/or gravel suitable for use as construction aggregate may occur. However, testing and evaluation would be required on a site-specific basis to assess the suitability of these deposits as sources of sand and gravel for use as construction aggregate.

AREAS IDENTIFIED (S&G)^{G}

Areas identified as (S&G)^{G} contain sand and gravel resources of glacial or glaciofluvial origin. These deposits occur throughout the eastern and central parts of Nevada County.

Deposits of glacial origin represent materials that were picked up or scraped along by the moving ice of the glacier. These deposits, often referred to as "till" or "moraine" deposits, are typically very poorly sorted and may contain large amounts of very fine materials (glacial flour) and/or very large boulders. This poor sorting often makes these deposits unlikely sources of construction aggregate unless they are processed extensively.

Deposits of glaciofluvial origin have been transported and/or deposited by moving water resulting from the melting of glacial ice. Such outwash deposits represent reworked glacial materials and tend to be better sorted and somewhat finer-grained than the glacial deposits from which they were derived. Sand and gravel deposits of glaciofluvial origin, therefore, have a higher potential for use as construction aggregate than those of glacial origin.

Another factor in determining the suitability of glacial or glaciofluvial materials for use as construction aggregate is the degree of weathering of the deposits. Older deposits tend to be more severely weathered than younger deposits. This may reduce the physical strength of the materials and make them less suitable as sources of construction aggregate. The ages of glacial and glaciofluvial deposits in Nevada County vary. The younger glacial and glaciofluvial deposits in eastern Nevada County (Tahoe- and Tioga- stage deposits) are 50,000 years old or younger, and the older deposits such as the Donner Lake and Sherwin-stage deposits are 250,000 years old or older. The various glacial and glaciofluvial deposits in the Truckee - Martis Valley area have been mapped by Birkeland (1961). However, in much of Nevada County, no detailed mapping delineating the various ages of glacial and glaciofluvial deposits exists. Discussions with aggregate producers in eastern Nevada County indicate that it is unlikely that construction aggregate could be produced from the older glacial and glaciofluvial deposits in the area at the present time because the materials are too weathered and the amount of processing required would be economically prohibitive.

Currently construction aggregate is commercially produced from outwash deposits of Tahoe or Tioga stage in the Martis Valley area in eastern Nevada County. The rock types present in these deposits are predominantly igneous and metamorphic, with lesser amounts of volcanic materials. In the past, aggregate has been commercially produced from similar deposits in the Donner Lake and Hirschdale areas.

Areas Classified MRZ-2a (S&G)^{G}:

MRZ-2a (S&G)$^{G-1}$ - Martis Valley Area: This deposit lies in northeastern Martis Valley north of the Martis Valley Reservoir. The material consists of sands, gravels, silts, and clays of Tahoe-stage glacial outwash deposits. Teichert Aggregates has been producing construction aggregate from a portion of this

deposit since 1985. Teichert markets the material from this site as base, asphaltic concrete aggregate, and portland cement concrete aggregate.

Areas Classified MRZ-2b (S&G)^{G}:

MRZ-2b (S&G)$^{G-2}$ - Martis Valley Area: This deposit extends from Highway 89 to the eastern edge of Martis Valley along the course of the Truckee River. The material consists of sands, gravels, silts, and clays of Tahoe- and Tioga-stage glacial outwash deposits. Teichert Aggregates produces construction aggregate from a portion of this deposit (MRZ-2a (S&G)$^{G-1}$). Portions of this deposit are covered by the town of Truckee.

MRZ-2b (S&G)$^{G-3}$ - Hirschdale Area: This deposit lies south of Boca Reservoir near the town of Hirschdale. The material consists of sands, gravels, silts, and clays of Tahoe- and Tioga-stage glacial outwash deposits. This deposit has abundant sand-size material and is low in fines, according to the local operators. Construction aggregate for use as base, asphaltic concrete, and portland cement concrete has been produced commercially from the northern portion of this deposit in the past by Sutherland Construction Company and possibly others. The deposit is not currently being mined.

MRZ-2b (S&G)$^{G-4}$ - Boca Reservoir Area: This deposit lies northeast of Boca Reservoir and consists of Tahoe-stage glacial outwash deposits similar to those in the Martis Valley area. This deposit has never been commercially mined.

MRZ-2b (S&G)$^{G-5}$ - Gateway Area: This deposit lies near Gateway in the Donner - Truckee area of eastern Nevada County. The deposit consists of Tioga-stage glacial outwash deposits similar to those previously mined by Caltrans and Teichert to the southwest.

Areas Classified MRZ-3a (S&G)^{G}:

MRZ-3a (S&G)$^{G-6}$ - Donner Lake Area: This deposit lies just southwest of the intersection of state highways 80 and 89. The deposit consists of Tioga-stage glacial outwash deposits similar to those previously mined for base and asphaltic concrete materials by Caltrans and Teichert Aggregates to the west. It is not known whether the volume of material present in this deposit is sufficient to meet threshold.

Areas Classified MRZ-3b (S&G)^{G}:

Areas classified MRZ-3b(S&G)^{G} indicate sand and gravel deposits of glacial or glaciofluvial origin for which no conclusive information indicating commercial potential was found. These 52 deposits, which occur in eastern and east-central Nevada County, represent a favorable geologic environment in which sand and/or gravel suitable for use as construction aggregate may

occur. However, testing and evaluation would be required on a site-specific basis to assess the suitability of these deposits as sources of sand and gravel for use as construction aggregate.

OVERVIEW OF SMARA DESIGNATION

This report completes the classification phase of the two-step process mandated by SMARA. The classification phase results in a complete product in and of itself. However, at the discretion of the State Mining and Geology Board, a second phase, termed "designation," may follow. The designation phase follows receipt and approval of this classification report by the State Mining and Geology Board. Designation is an additional recognition by the State Mining and Geology Board of areas containing mineral deposits of regional or statewide significance that should be given special consideration by lead agencies for protection from land uses incompatible with mineral extraction. Recognition is achieved by the adoption of regulations which designate certain deposits to be of prime importance in meeting the future needs of the region or the state. Designation is based upon this DMG report and consultation with lead agencies and other interested parties. Procedures for the designation of lands containing significant mineral deposits are specified in Section II.2 of the State Mining and Geology Board's Guidelines for Classification and Designation of Mineral Lands (California State Mining and Geology Board, 1983, p. 23).

Regardless of whether the State Mining and Geology Board pursues designation of mineral deposits in Nevada County, local government is still required under SMARA to recognize the information provided in this report, and to emphasize the conservation and development of identified mineral deposits. To assist local government in this role, some relative quantification of aggregate resources (both available tonnages and projected demand) provides essential information in evaluating proposed land uses for specific sites. Only with this perspective can sound local decisions regarding the long-term availability of mineral resources be made.

In the past, the State Mining and Geology Board has limited the practice of designation to construction aggregate resources. Since aggregate is a low unit-value, high bulk-weight commodity that must be obtained from nearby sources to minimize transportation costs, it is possible to define deposits as "significant" on a regional basis. High unit-value mineral commodities such as gold or copper may reach markets worldwide and it is difficult to establish a framework of "regional significance" for these commodities.

PART V - AGGREGATE RESOURCE AREAS IN NEVADA COUNTY

Recognizing that there are lands within MRZ-2 areas that have already been urbanized and therefore have a limited opportunity for mineral resource conservation and extraction, the State Geologist has limited the quantification of aggregate resources to areas classified as MRZ-2 for construction aggregate that have not been urbanized. The nonurbanized portions of MRZ-2a and MRZ-2b areas are called "Aggregate Resource Areas."

Construction aggregate is generally extracted from surface mines (open pits or quarries) because of the nature of the deposits and the low unit-value of the commodity. Metallic and other nonmetallic mineral commodities can be mined from surface workings, but may also be extracted from underground workings if the value of the commodity and the nature of the deposit make underground mining economical. Underground mining creates less surface disturbance than surface mining and may be compatible with levels of urbanization with which surface mining would not. Additionally for certain high-value commodities, such as gold, the value of a deposit may allow a mining company to purchase surface rights in urbanized areas where lower value commodities such as construction aggregate would not justify such an expense. For these reasons, the urbanized portions of areas classified MRZ-2a or MRZ-2b for commodities other than construction aggregate have not been excluded to create "Metallic or Non-metallic Resource Areas" analogous to the Aggregate Resource Areas used in this section of this report.

CONCEPTS USED IN IDENTIFYING AGGREGATE RESOURCE AREAS

An Aggregate Resource Area (ARA) is an area that has been classified as MRZ-2a or MRZ-2b for construction aggregate by the State Geologist and is deemed to be available for mining based upon criteria for compatibility provided by the State Mining and Geology Board and outlined below.

For purposes of classification, incompatible uses of land are defined as high-cost improvements (such as high-density residential developments), intensive industrial developments, commercial developments, developed public parks, and major public facilities. In addition, lands for which the lead agency has approved a tract map or issued an approved Specific Plan are treated as having uses that are incompatible with mining. Lands that have compatible uses are defined as those that are non-urbanized or that have very low-density residential development (one unit or less per ten acres), land that does not have high-cost improvements, and lands used for agriculture, silviculture, grazing, or open space.

For this report, determination of use of lands classified as MRZ-2a or MRZ-2b for construction aggregate was based upon conditions of the lands at the time of the study (1989 - 1990). The use of the lands was determined after review of data from lead agencies, reference to aerial photographs and photo-revised topographic maps, and limited field reconnaissance. The Aggregate Resource Areas Map (Plate 7) shows the portions of those areas classified MRZ-2a or MRZ-2b considered to have current land uses compatible with mining.

Each Aggregate Resource Area meets or exceeds the State Mining and Geology Board's threshold value for deposits of significant size. The State Geologist has divided the Aggregate Resource Areas into three categories as follows: IS (Immediately Significant), HS (Highly Significant), and S (Significant). These categories are based on a semi-quantitative evaluation of suitable aggregate resources classified as MRZ-2a or MRZ-2b. The criteria for these categories follow:

IS - All lands within Aggregate Resource Areas which are currently permitted for aggregate mining.

HS - Aggregate Resource Areas that contain in excess of 10 times threshold value of material (approximately 1.94 million tons at 1989 prices in Nevada County), or that are adjacent to permitted property.*

S - All remaining Aggregate Resource Areas containing at least 1.94 million tons of material.*

* If conditions warrant, an Aggregate Resource Area category can be changed from HS to S or from S to HS. These conditions may include, but are not limited to, local scarcity of commodity, proximity to an operating aggregate mine, and distance from market areas.

Aggregate Resource Areas have been employed to focus the attention of land-use planners and local governments on areas that remain accessible for mineral extraction. Mineral land classification, which is done without regard for current land uses, by itself, does very little to put into perspective the resource base that is available to meet the future needs of a region.

AGGREGATE RESOURCE AREAS

Aggregate Resource Areas in Nevada County are shown on Plates 7a-c. The relationship between areas classified MRZ-2a or MRZ-2b in this report and the resulting Aggregate Resource Areas are described below. Highest use indicates the highest potential use of the material in a deposit based on current or past

production or tests from that deposit or similar deposits in the region. Further testing and evaluation could either upgrade or downgrade the potential highest use of a deposit. The Aggregate Resource Areas and their respective categories of significance are summarized in Table 3.

ARA-1 - Mooney Flat Area: MRZ-2b (S&G)[A-5] was included in its entirety in ARA-1 (see plate 7-a). ARA-1 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-2 - North San Juan/French Corral Area: MRZ-2b (S&G)[A-9] was included in its entirety in ARA-2 (see plate 7-a). ARA-2 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-3 - North San Juan/French Corral Area : MRZ-2b (S&G)[A-10] was included in its entirety in ARA-3 (see plate 7-a). ARA-3 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-4 - Shady Creek Area: MRZ-2b (S&G)[A-7] was included in its entirety in ARA-4 (see plate 7-a). ARA-4 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-5a, ARA-5b, ARA-5c - San Juan Ridge West Area: MRZ-2b (S&G)[A-12] was included in ARA-5a, ARA-5b, and ARA-5c (see plates 7-a). In ARA-5b, that portion of the deposit on which the town of North Columbia sits was excluded. ARA-5a, ARA-5b, and ARA-5c are collectively in the Highly Significant category since the amount of material they contain is far in excess of ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from these deposits is base.

ARA-6 and ARA-6a - Trood Placer Mine Area: MRZ-2a (S&G)[A-4] was included in its entirety in ARA-6 and ARA-6a (see plate 7-a). ARA-6a consists of the portion of the deposit which is presently permitted for aggregate mining and operated by Desert Gold, Inc. / N.C. Gravel. ARA-6a is in the Immediately Significant category since it is presently permitted for mining. ARA-6 consists of the unpermitted portion of the MRZ. Desert Gold, Inc. / N.C. Gravel controls a portion of this unpermitted area. ARA-6 is in

the Highly Significant category because of its proximity to a permitted property. Based on current production from this deposit, the highest probable use of material from this deposit is portland cement concrete.

ARA-7 - Sailor Flat/Blue Tent Area: MRZ-2b (S&G)[A-14] was included in its entirety in ARA-7 (see plate 7-a). ARA-7 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-8 - Deer Creek Area: MRZ-2b (S&G)[A-6] was included in its entirety in ARA-8 (see plate 7-a). ARA-8 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-9 and ARA-9a - Grass Valley Area: MRZ-2a (CS)[M-2] was included in its entirety in ARA-9 and ARA-9a. ARA-9a represents the portion of the deposit that is presently permitted for aggregate mining and operated by North Star Rock Products, Inc. (see plate 7-a). ARA-9a is therefore included in the Immediately Significant category. ARA-9 consists of the unpermitted portion of the MRZ. ARA-9 is in the Highly Significant category because of its proximity to a permitted property. Based on current production from this deposit, the highest probable use of material from this deposit is base.

ARA-10 - Scotts Flat/Little York Area: MRZ-2b (S&G)[A-15] was included in its entirety in ARA-10 (see plate 7-a). ARA-10 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-11 - Scotts Flat/Little York Area: MRZ-2b (S&G)[A-16] was included in its entirety in ARA-11 (see plate 7-a). ARA-11 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-12 - Scotts Flat/Little York Area: MRZ-2b (S&G)[A-17] was included in ARA-22 except for that portion which is the site of the settlement of You Bet (see plate 7-a). ARA-12 is in the Highly Significant category since the amount of material present is in excess of ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-13 - Greenhorn Creek Area: MRZ-2a (S&G)[A-3] was included in its entirety in ARA-13, ARA-14, and ARA-15 (see plate 7-a). ARA-13 consists of the portion of the deposit that is presently permitted for mining and operated by Hansen Brothers Enterprises, Inc. ARA-13 is in the Immediately Significant category since it is presently permitted for mining. Based on current production from this deposit, the highest probable use of material from this deposit is portland cement concrete.

ARA-14 - Greenhorn Creek Area: MRZ-2a (S&G)[A-3] was included in its entirety in ARA-13, ARA-14, and ARA-15 (see plate 7-a). ARA-14 consists of the adjoining portion of the deposit that is controlled by Hansen Brothers Enterprises, Inc., but that is not currently permitted for mining. ARA-14 is in the Highly Significant category because of its proximity to a permitted property. Based on similar adjacent deposits, the highest probable use of material from this deposit is portland cement concrete.

ARA-15 - Greenhorn Creek Area: ARA-15 consists of the portion of MRZ-2a (S&G)[A-3] upstream of A-14 (see plate 7-a). ARA-15 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Unlike ARA-14, this portion of the deposit may be too far from the permitted portion of the deposit (ARA-13) to be mined in conjunction with it. Based on similar deposits in the region, the highest probable use of material from this deposit is portland cement concrete.

ARA-16 - Scotts Flat/Little York Area: MRZ-2b (S&G)[A-18] was included in its entirety in ARA-16 (see plates 7-a and 7-b). ARA-16 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-17 - Bear River Area: MRZ-2b (S&G)[A-8] was included in its entirety in ARA-17 (see plate 7-a). ARA-17 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is portland cement concrete.

ARA-18 - Lake Combie Area: MRZ-2a (CS)[M-1] was included in its entirety in ARA-18 (see plate 7-a). This ARA is presently permitted for aggregate mining and is operated by the Joe Chevreaux Company. ARA-18 is in the Immediately Significant category since it is presently permitted for mining. Based on current production from this deposit, the highest probable use of material from this deposit is portland cement concrete.

ARA-19 - Bear River/Lake Combie Area: MRZ-2a (S&G)$^{A-1}$ was included in its entirety in ARA-19 (see plate 7-a). This ARA is presently permitted for aggregate mining and is operated by the Joe Chevreaux Company. ARA-19 is in the Immediately Significant category since it is presently permitted for mining. Based on current production from this deposit, the highest probable use of material from this deposit as construction aggregate is portland cement concrete. This deposit is also a source of a variety of specialty aggregate products.

ARA-20 and ARA-20a - Bear River/Steephollow Creek Area: MRZ-2a (S&G)$^{A-2}$ was included in its entirety in ARA-20, ARA-20a, ARA-21, ARA-22, ARA-23, and ARA-24. ARA-20a consists of the portion of the deposit currently permitted for mining and operated by the R. J. Miles Company (see plate 7-a). ARA-20a is in the Immediately Significant category since it is presently permitted for mining. ARA-20 consists of the small parts of the deposit adjoining ARA-20a along the Bear River and Steephollow Creek (see plate 7-b). ARA-20 is in the Highly Significant category because of its proximity to a permitted property (but would have to be mined in conjunction with ARA-20a to establish threshold). Based on current production from this deposit, the highest probable use of material from this deposit is portland cement concrete.

ARA-21 - Bear River/Steephollow Creek Area: ARA-21 consists of the portion of MRZ-2a (S&G)$^{A-2}$ along Steephollow Creek adjoining the northern boundary of ARA-20a (the R.J. Miles property, see plate 7-a). ARA-21 is in the Highly Significant category because of its proximity to a permitted property. Based on similar adjacent deposits, the highest probable use of material from this deposit is portland cement concrete.

ARA-22 - Bear River/Steephollow Creek Area: ARA-22 consists of the northernmost portion of MRZ-2a (S&G)$^{A-2}$ along Steephollow Creek (see plate 7-a). ARA-22 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is portland cement concrete.

ARA-23 - Bear River/Steephollow Creek Area: ARA-23 consists of the portion of MRZ-2a (S&G)$^{A-2}$ along the Bear River that adjoins the upstream boundary of ARA-20a on the Bear River (see plates 7-a and 7-b). ARA-23 is in the Highly Significant category because of its proximity to a permitted property. Based on the adjoining deposit, the highest probable use of material from this deposit is portland cement concrete.

ARA-24 - Bear River/Steephollow Creek Area: ARA-24 consists of the portion of MRZ-2a (S&G)$^{A-2}$ that extends from the Dutch Flat area to the upper boundary of ARA-23 (see plate 7-b). ARA-24 is in the Significant category since the amount of material present

is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is portland cement concrete.

ARA-25 - Liberty Hill Diggings/Lowell Hill Area: MRZ-2b (S&G)[A-19] was included in its entirety in ARA-25 (see plate 7-b). ARA-25 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-26 - Omega Diggings Area: MRZ-2b (S&G)[A-20] was included in ARA-26 except for that portion which is the site of the settlement of Omega (see plate 7-b). ARA-26 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is base.

ARA-27 and ARA-27a - Martis Valley Area: MRZ-2a (S&G)[G-1] was included in its entirety in ARA-27 and ARA-27a. ARA-27a represents the portion of this Aggregate Resource Area that is presently permitted for mining and is operated by Teichert Aggregates (see plate 7-c). ARA-27a is in the Immediately Significant category since it is presently permitted for mining. ARA-27 represents the portion of the Aggregate Resource Area that is not presently permitted for mining (see plate 7-c). ARA-27 is in the Highly Significant category because of its proximity to a permitted property. Based on current production from this deposit, the highest probable use of material from this deposit is portland cement concrete.

ARA-28 - Martis Valley Area: ARA-28 consists of the portion of MRZ-2b (S&G)[G-2] in the northern portion of Martis Valley (see plate 7-c). Portions of the deposit covered by parts of the town of Truckee and parts of the U.S. Interstate 80 corridor were excluded from the Aggregate Resource Area. ARA-28 is in the Highly Significant category since the amount of material present is in excess of ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is portland cement concrete.

ARA-29 Martis Valley Area: ARA-29 consists of the northernmost portion of MRZ-2b (S&G)[G-2] and is separated from ARA-28 by U.S. Interstate 80, which was excluded from the Aggregate Resource Area (see plate 7-c). ARA-29 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on similar deposits in the region, the highest probable use of material from this deposit is portland cement concrete.

ARA-30 and ARA-30a - Juniper Flat Area: This eastern portion of MRZ-2a (CS)[V-1] was excluded from ARA-30 because of the presence of the Glenshire housing development. The remaining portion of the resource is controlled by Sha-Neva, Inc. and is divided into ARA-30 and ARA-30a (see plate 7-c). ARA-30a is that portion of the deposit in the north half of section 32. Sha-Neva, Inc. is currently mining this portion of the deposit and ARA-30a is in the Immediately Significant category. ARA-30 is that portion of the deposit in the south half of section 32. Nevada County and Sha-Neva, Inc. were in disagreement about Sha-Neva's right to mine this portion of the deposit at the time this report was being written. ARA-30 is in the Highly Significant category because of its proximity to an operating mine. Based on current production from this deposit, the highest probable use of material from this deposit is base.

ARA-31 - Hirschdale Area: MRZ-2b (S&G)[G-3] was included in ARA-31 except for the portion of the deposit covered by the town of Hirschdale and the northern portions of the deposit covered by Boca, the railroad, and U.S. Interstate 80 (see plate 7-c). ARA-31 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. Based on past production from this deposit, the highest probable use of material from this deposit is portland cement concrete.

ARA-32 - Boca Reservoir Area: MRZ-2b (S&G)[G-4] was included in its entirety in ARA-32 (see plate 7-c). ARA-32 is in the Significant category since the amount of material present is one to ten times the threshold amount required for classification. It is likely that material from this deposit is suitable for base or subbase, although testing and evaluation might prove the materials suitable for uses such as asphaltic concrete or portland cement concrete.

AREAS NOT INCLUDED IN AGGREGATE RESOURCE AREAS

The following Mineral Resource Zones were not considered Aggregate Resource Areas because of the presence of urbanization or other incompatible land use.

MRZ-2b (S&G)[A-11] - North San Juan/French Corral Area: This MRZ was not considered an Aggregate Resource Area because of the presence of the town of North San Juan within a portion of it. It is doubtful that the amount of material within the nonurbanized portion of this MRZ is sufficient to meet threshold.

MRZ-2b (S&G)[A-13] - Malakoff Diggings Area: This MRZ was excluded from consideration as an Aggregate Resource Area because of the presence of Malakoff Diggings State Park, which covers a large portion of the deposit. It is unlikely that the resources

remaining outside of the park boundaries could be mined because of the distribution of the resources and their proximity to the park.

MRZ-2b (S&G)$^{G-5}$ - Gateway Area: This MRZ was excluded from consideration as an Aggregate Resource Area because of the presence of the town of Gateway, which covers most of the resource.

Table 3. Aggregate Resource Areas in Nevada County

ARA#	CATEGORY*	HIGHEST USE**	PLATE
ARA-1	S	base	7-a
ARA-2	S	base	7-a
ARA-3	S	base	7-a
ARA-4	S	base	7-a
ARA-5a	HS	base	7-a
ARA-5b	HS	base	7-a
ARA-5c	HS	base	7-a
ARA-6	HS	PCC	7-a
ARA-6a	IS	PCC	7-a
ARA-7	S	base	7-a
ARA-8	S	base	7-a
ARA-9	HS	base	7-a
ARA-9a	IS	base	7-a
ARA-10	S	base	7-a
ARA-11	S	base	7-a, 7-b
ARA-12	HS	base	7-a
ARA-13	IS	PCC	7-a
ARA-14	HS	PCC	7-a
ARA-15	S	PCC	7-a
ARA-16	S	base	7-a, 7-b
ARA-17	S	PCC	7-a
ARA-18	IS	PCC	7-a
ARA-19	IS	PCC	7-a

Table 3. Aggregate Resource Areas in Nevada County (continued)

ARA#	CATEGORY*	HIGHEST USE**	PLATE
ARA-20	HS	PCC	7-a
ARA-20a	IS	PCC	7-a
ARA-21	HS	PCC	7-a
ARA-22	S	PCC	7-a
ARA-23	HS	PCC	7-a, 7-b
ARA-24	S	PCC	7-b
ARA-25	S	base	7-b
ARA-26	S	base	7-b
ARA-27	HS	PCC	7-c
ARA-27a	IS	PCC	7-c
ARA-28	HS	PCC	7-c
ARA-29	S	PCC	7-c
ARA-30	HS	base	7-c
ARA-30a	IS	base	7-c
ARA-31	S	PCC	7-c
ARA-32	S	base	7-c

* IS = IMMEDIATELY SIGNIFICANT, HS = HIGHLY SIGNIFICANT, S = SIGNIFICANT

** Highest Use indicates the highest potential use of material in a deposit based on current or past production or tests from that deposit or similar deposits in the region. Further testing and evaluation could either upgrade or downgrade the potential highest use of a deposit. PCC = portland cement concrete

PART VI - FORECAST OF CONSTRUCTION AGGREGATE NEEDS IN NEVADA COUNTY

This section of the report contains an assessment of the total reserves of construction aggregate in Nevada County and addresses some of the factors that will affect the life span of those reserves.

Much of Nevada County is rural and the population of the county is unevenly distributed in the western and eastern portions of the county. For the purposes of this report, western Nevada County is the portion of the county that lies west of Lake Spaulding and eastern Nevada County is the portion that lies east of Lake Spaulding. In the western part of the county, the population is concentrated in the Grass Valley, Nevada City, Lake Wildwood, Penn Valley, Rough and Ready, Lake of the Pines, and Alta Sierra areas along State Highway 49 and State Highway 20 corridors. In the eastern part of the county, the population is concentrated in the Donner, Truckee, and Martis Valley areas. Much of the central portion of Nevada County is part of the Tahoe National Forest and no significant urban areas exist within this portion. Table 4 shows the projected population growth and distribution for Nevada County for the years 1990 to 2020 and illustrates the uneven distribution of the population between the eastern and western portions of the county. Approximately 89 percent of the population is located in the western portion of the county and approximately 11 percent in the eastern portion of the county. Table 4 also indicates that the population in the county is projected to more than double from 81,400 in 1990 to 171,800 by 2020.

AGGREGATE PRODUCTION IN NEVADA COUNTY

At the time of this study, the following six companies had permitted mining operations producing construction aggregate in Nevada County:

Hansen Brothers Enterprises, Inc.
Desert Gold, Inc. / N. C. Gravel
R. J. Miles Company
North Star Rock Products, Inc.
Sha-Neva, Inc.
Teichert Aggregates

North Star Rock Products, Inc. and Sha-Neva, Inc. produce crushed stone for use as construction aggregate, and the remaining four operations produce sand and gravel for use as

Table 4. Projected population increases, Nevada County 1990 - 2020*

AREA	YEAR 1990	2000	2010	2020
Western County	72,400	99,200	126,000	152,900
Eastern County	9,000	12,300	15,600	18,900
Nevada County Total	81,400	111,500	141,600	171,800

* Nevada County Fact Book, 1987

construction aggregate. Hansen Brothers Enterprises, Inc., Desert Gold, Inc. / N. C. Gravel, R. J. Miles Company, and North Star Rock Products, Inc. have operations in western Nevada County. Sha-Neva, Inc. and Teichert Aggregates have operations in the Truckee area of eastern Nevada County. Because of the geography of Nevada County and the distances involved, it is generally not economical for construction aggregate to be transported from the western end of the county to the eastern portion or vice versa. Therefore, eastern and western Nevada County are more or less independent of one another in the consumption and production of construction aggregate.

In addition to these six operators located within Nevada County, the Joe Chevreaux Company produces both sand and gravel and crushed stone from the Lake Combie area on the border of Nevada and Placer counties. The Chevreaux property has been previously classified by the Division of Mines and Geology (Dupras, 1983) and that classification has not been altered in this report. Since the Joe Chevreaux Company operation at Lake Combie reports its production to the U.S. Bureau of Mines as originating from Placer County, the Chevreaux operation is considered to be in Placer County the purposes of this report.

Figure 6 shows the production of construction aggregate in Nevada County for the years 1970 to 1988. The historical aggregate production data for the study area were obtained from mining records of the U.S.Bureau of Mines and from the aggregate companies. The U.S. Bureau of Mines records are compiled from voluntary responses to questionnaires that are sent annually or semi-annually to all known mining operators. Each producer is requested to divulge the production from each producing property for the preceding year. The degree of accuracy of these statistics depends upon the completeness of the U.S. Bureau of Mines canvass and on the producer's response. The DMG staff did not verify historic production data in the U.S. Bureau of Mines files but, through interviews with the various mine operators, they checked current production, determined exports and imports, and modified the U.S. Bureau of Mines data as appropriate.

The amount of aggregate produced in Nevada County has varied from just under 700,000 tons to approximately 1,250,000 tons for the years 1970 to 1988 (Figure 6). The variations from year to year in the production rate may reflect changes in urban growth rates, intermittent large construction projects (e.g., freeways, dams, and canals), or variations in the economy. In Nevada County the weather can also affect aggregate production since severe winters can shorten the production season of aggregate operations. In part, these variations may also result from incompleteness and inaccuracies in the production records supplied by the U.S. Bureau of Mines.

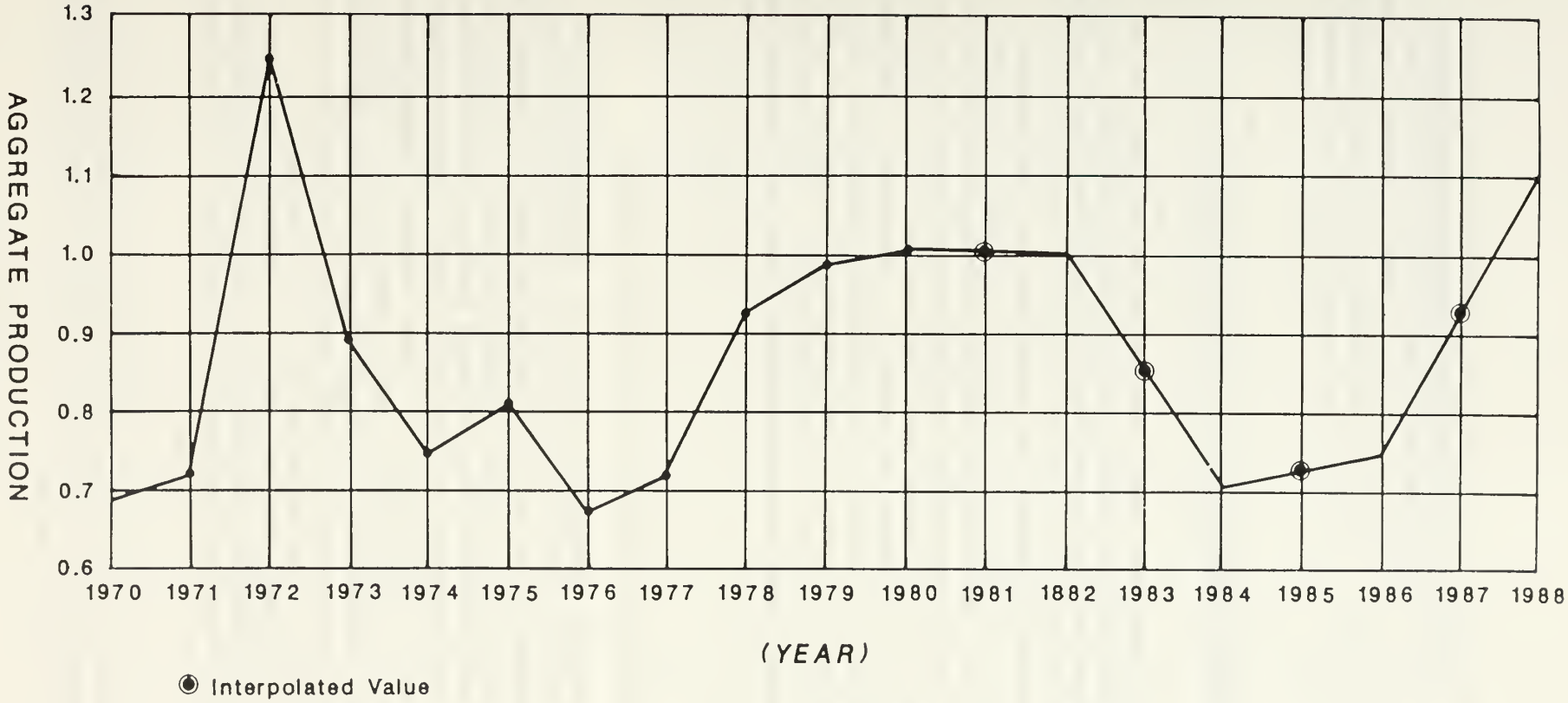


Figure 6. Aggregate production in Nevada County for the years 1970 to 1988. Includes both crushed stone and sand and gravel. Data from U.S. Bureau of Mines records or modified from U.S. Bureau of Mines records.

Due to the limited number of aggregate producers in Nevada County, it is not possible to divulge separate aggregate production values for individual Aggregate Resource Areas or for the eastern and western portions of the county without releasing proprietary information. For the years 1978 to 1988, however, the aggregate production rate for the county as a whole averaged 915,000 tons per year.

AGGREGATE CONSUMPTION IN NEVADA COUNTY

The average production rate of 915,000 tons per year does not accurately indicate how much construction aggregate is actually consumed in Nevada County each year. Discussions with the aggregate operators in Nevada County indicate that while some material is exported (approximately 140,000 tons per year), Nevada County is a net importer of construction aggregate. Nevada County currently imports 20 to 30 percent (183,000 to 275,000 tons per year) more aggregate than is produced in the county each year; these estimates reflect conditions of the last four to five years. This means that the actual consumption of construction aggregate in Nevada County is currently 958,000 to 1,050,000 tons per year based on an average production rate of 915,000 tons per year (915,000 tons produced locally + 183,000 to 275,000 tons imported - 140,000 tons exported). Construction aggregate is imported into eastern Nevada County from the state of Nevada and into the western portion of the county from Yuba and Placer counties.

AGGREGATE RESERVES IN NEVADA COUNTY

Aggregate Resource Areas (see Part V) identified as Immediately Significant (IS) are important to the county because they contain resources that are presently permitted for mining and represent the current sources of construction aggregate in Nevada County as well as the most likely sources of construction aggregate in the near future. A more specific term for these permitted resources is reserves. In this report, reserves are resources of aggregate that have been determined to be acceptable for commercial use, that exist within properties owned or leased by aggregate producing companies, and for which permits have been granted to allow mining and processing of the material. Resources include reserves as well as all potentially usable aggregate materials that may be mined in the future, but for which no permit allowing mining has been granted, or for which marketability has not been established.

The reserves of construction aggregate in Nevada County have been determined based on the combined reserve tonnages of the following six companies that currently have permitted aggregate mining operations in the county:

Hansen Brothers Enterprises, Inc.
Desert Gold, Inc. / N. C. Gravel
R. J. Miles Company
North Star Rock Products, Inc.
Sha-Neva, Inc.
Teichert Aggregates

The reserves of the Joe Chevreaux Company operation at Lake Combie are excluded because they are considered to be in Placer County for the purposes of this report.

The construction aggregate reserves contained within Nevada County are 28,560,000 tons. Because of the small number of producers in Nevada County, only a single reserve number for the county can be given without divulging proprietary data. More than one-half of the construction aggregate reserves are located in the Truckee - Martis Valley region of the county, which has approximately 11 percent of the population. Less than one-half of the reserves of construction aggregate are located in the western part of the county where approximately 89 percent of the population is located. In eastern Nevada County, it is likely that less than one-half of the reserves of construction aggregate are suitable for use as portland cement concrete or asphaltic concrete and that the remainder of the reserves is likely to be suitable only for uses such as base or subbase. In western Nevada County, it is likely that over one-half of the reserves of construction aggregate are suitable for uses such as portland cement concrete and asphaltic concrete and the balance of the reserves is likely to be suitable only for uses such as base or subbase.

The reserve base of 28,560,000 tons represents a starting point for planning purposes as of 1990; however, it is not a static number. The reserves will be progressively depleted by annual production from the operating mines within the county as they provide increasing tonnages of construction aggregate to meet local demand. Reserves may be supplemented to an unknown degree by replenishment (see below). If no new mining permits are granted, the reserve base will ultimately be depleted and Nevada County will be forced to rely entirely on imported aggregate at higher prices (due to increased transportation costs). If aggregate exports increase, the reserve base will be depleted more quickly. If aggregate imports into the county increase, the life span of the local reserves will be correspondingly lengthened, but at a cost of increased truck traffic, road wear, fuel consumption, and construction aggregate prices.

REPLENISHMENT OF AGGREGATE RESERVES IN WESTERN NEVADA COUNTY

Some additions to the reserve base may take place through natural geologic processes as sand and gravel is replenished at some of the instream operations in western Nevada County. This can be expected to occur at operations on the Bear River and on Greenhorn Creek upstream of Rollins Reservoir (R. J. Miles Company and Hansen Brothers Enterprises, Inc.). Replenishment of sand and gravel is likely to be greatest during the wet season in years of normal or above normal rainfall. Replenishment of sand and gravel is less likely downstream of Rollins Reservoir due to the trapping action of the dam and reservoir.

Material replenishment at these sites is likely to extend the reserve base in western Nevada County but the degree to which it may be extended is difficult to assess for reasons including, but not limited to, the following:

- Lack of site-specific data on rate and volume of material replenishment at the currently permitted operations (R. J. Miles Company and Hansen Brothers Enterprises, Inc.).
- Lack of data regarding the proportion of replenished material that is suitable for use as construction aggregate. This is likely to vary from mine site to mine site.
- Lack of data on the long-term cyclical nature of material replenishment because of floods and droughts. The supply of replenished material may be unpredictable and unavailable when needed.

The determination of these factors is beyond the scope of this study. It is not possible to quantify the effects of material replenishment on the construction aggregate reserves of western Nevada County beyond stating that the reserve base is likely to be extended by material replenishment. It should be noted that even if the construction aggregate reserves of western Nevada County are extended by material replenishment, increased aggregate demand with projected population growth will eventually outstrip both replenishment and reserves.

DEPLETION OF AGGREGATE RESERVES IN NEVADA COUNTY

Because of the uneven distribution of reserves and population in Nevada County, the depletion of aggregate reserves will be discussed relative to the western portion of the county and the eastern portion of the county. Since the goal of forecasting the depletion dates of construction aggregate reserves is to give decision-makers a reliable base from which to

make land-use decisions, and the effects of material replenishment of instream operations in western Nevada County cannot be reliably determined at this time, no attempt has been made to account for material replenishment in the projection of aggregate depletion.

Past studies of marketing regions in California have shown that there is a strong correlation between the amount of aggregate produced and the population in a given aggregate production-consumption region (Anderson and others, 1979). As population increases in a lightly populated area such as Nevada County, total aggregate consumption and the rate of aggregate consumption normally increase as new housing, roads, and public facilities are built.

Because of the correlation between population growth and aggregate demand, it is unrealistic to assume that the past 915,000-ton-per-year production average (see page 74) will remain static as population grows. Based on the population growth projections in Table 4, the projected growth rate for both eastern and western Nevada County is 3.7 percent per year. Therefore, aggregate consumption in both portions of the county, and the county as a whole, can be expected to rise by 3.7 percent per year.

There are three options by which the increased demand for construction aggregate in Nevada County may be met. First, the existing aggregate operations could increase their production, if possible, to meet the increased demand (accelerating the depletion of presently permitted reserves). Second, new aggregate operations could be permitted to keep up with increasing demand. Third, additional imports of aggregate from outside of Nevada County could enter the market. These options are not mutually exclusive and it is likely that some combination of the three will occur over the long term.

For planning purposes, only the first option is predictable. It can be used to approximate the depletion date of the 1990 reserve base of 28,560,000 tons of construction aggregate, based on a starting depletion rate of 915,000 tons per year. Table 5 shows the anticipated annual tonnage required to keep pace with the projected 3.7 percent growth rate in the county. Based on the above model, the reserve base in Nevada County will be depleted in 22 years, sometime during the year 2012.

There are only two aggregate producers (Sha-Neva, Inc. and Teichert Aggregates) in the eastern portion of Nevada County. Because of the small number of producers, it is not possible to release specific values for the reserve base or production rate in the eastern county without releasing proprietary information. However, using the same model with the specific reserve and production rate information for the eastern and western portions

of the county, depletion dates can be calculated for each region. These depletion dates can then be released without revealing proprietary data, although the factors used to derive them cannot.

The construction aggregate reserves of western Nevada County will be depleted in 14 years, sometime in the year 2004. This number does not account for any potential replenishment of aggregate at currently permitted instream mine sites (R. J. Miles Company and Hansen Brothers Enterprises, Inc.). Eastern Nevada County's construction aggregate reserves will be depleted in 31 years, sometime in the year 2021. This marked difference in life expectancy of reserves is because of the larger initial population and smaller reserve base in the western portion of the county.

The expected longevity of aggregate reserves is based upon the assumption that the mining of these reserves will continue to be permitted until the reserves are depleted. In a predominantly rural county such as Nevada County, large public works projects such as new dams, new highways or the widening of existing highways could significantly affect the longevity of the aggregate reserves of the county. Figure 6 illustrates that considerable annual variations in aggregate production rate have occurred in Nevada County in the past, probably due, at least in part, to these causes. Should unforeseen events occur, such as massive urban renewal, reconstruction in the wake of a disaster, or a major economic recession, the demand for construction aggregate in Nevada County could change considerably, which could alter the life span of aggregate reserves in the county.

To increase the reserve base significantly, the permitting of new mines should be given serious consideration by aggregate producers, local planners and decision-makers. Planning for new mine sites can minimize incompatible adjacent land uses and environmental impacts can be more easily mitigated. To quantify the possibility of construction aggregate replenishment at currently permitted instream mine sites, the county may wish to conduct site-specific studies on Greenhorn Creek and on the Bear River.

AGGREGATE RESOURCES IN NEVADA COUNTY

As stated previously, resources include reserves as well as all potentially usable aggregate materials that may be mined in the future, but for which no permit allowing mining has been granted, or for which marketability has not been established.

Aggregate resources in Nevada County have not been precisely quantified. However, an approximate minimum tonnage of resources can be calculated using Table 3 and a threshold tonnage of 1.94

Table 5. Projected growth of construction aggregate production in Nevada County, 1990 - 2020.

YEAR	PROJECTED POPULATION	PROJECTED AGGREGATE PRODUCTION	CUMULATIVE AGGREGATE PRODUCTION	PERCENT DEPLETION
1990	81,380	915,000	915,000	3.2
1991	84,393	948,877	1,863,877	6.5
1992	87,406	982,754	2,846,630	10.0
1993	90,419	1,016,630	3,863,261	13.5
1994	93,432	1,050,507	4,913,768	17.2
1995	96,445	1,084,384	5,998,152	21.0
1996	99,458	1,118,261	7,116,413	24.9
1997	102,471	1,152,138	8,268,551	29.0
1998	105,484	1,186,014	9,454,565	33.1
1999	108,497	1,219,891	10,674,457	37.4
2000	111,510	1,253,768	11,928,225	41.8
2001	114,523	1,287,645	13,215,870	46.3
2002	117,536	1,321,522	14,537,391	50.9
2003	120,549	1,355,399	15,892,790	55.7
2004	123,562	1,389,275	17,282,065	60.5
2005	126,575	1,423,152	18,705,217	65.5
2006	129,588	1,457,029	20,162,246	70.6
2007	132,601	1,490,906	21,653,152	75.8
2008	135,614	1,524,783	23,177,935	81.2
2009	138,627	1,558,659	24,736,594	86.6
2010	141,640	1,592,536	26,329,131	92.2
2011	144,653	1,626,413	27,955,544	97.9
2012	147,666	1,660,290	29,615,834	103.7
2013	150,679	1,694,167	31,310,000	109.6
2014	153,692	1,728,043	33,038,044	115.7
2015	156,705	1,761,920	34,799,964	121.9
2016	159,718	1,795,797	36,595,761	128.1
2017	162,731	1,829,674	38,425,435	134.5
2018	165,744	1,863,551	40,288,986	141.1
2019	168,757	1,897,428	42,186,413	147.7
2020	171,770	1,931,304	44,117,718	154.5

million tons. Table 3 identifies 13 Highly Significant ARA's - ten of which are Highly Significant because of proximity to operating mines and three of which are Highly Significant based on tonnage of material present. Eighteen Significant ARA's are identified. Each of the three ARA's that are Highly Significant based on tonnage of material present contains at least ten times threshold tonnage (30 times threshold). The ten ARA's that are Highly Significant based upon proximity to operating mines (except for ARA-20 which would have to be mined in conjunction with ARA-20a to establish threshold) and the 18 Significant ARA's contain at least threshold tonnage of aggregate (27 times threshold). Therefore, the approximate minimum tonnage of non-permitted construction aggregate resources in Nevada County is equal to 57 times threshold tonnage or 110.6 million tons. Table 3 also identifies eight ARA's as Immediately Significant or containing areas of immediate significance (two of which are considered to be in Placer County for the purpose of this report). The six Immediately Significant ARA's in Nevada County contain the approximately 28.6 million tons of permitted construction aggregate reserves of the county. The approximate minimum tonnage of total resources is equal to the non-permitted resources (110.6 million tons) plus the permitted reserves (28.6 million tons) or 139.2 million tons.

As previously explained, the distribution of the permitted reserves of construction aggregate in Nevada County cannot be released because of the proprietary nature of the information, which also limits discussion of the distribution of the total reserves. However, the distribution of the minimum nonpermitted resources can be discussed. Of the 110.6 million tons of nonpermitted construction aggregate resources in Nevada County, 85.4 million tons occur in western Nevada County in 20 different ARA's and 25.2 million tons occur in eastern Nevada county in four different Aggregate Resource Areas.

In western Nevada County, present extraction of materials is concentrated in the recent deposits along the rivers and creeks of the county. Recent stream deposits along Greenhorn Creek (ARA-14, ARA-15), Steephollow Creek (ARA-21, ARA-22), and the Bear River (ARA-23) have been classified MRZ-2a for sand and gravel. These areas may represent the likely future sources of construction aggregate for uses such as portland cement concrete and asphaltic concrete in western Nevada County. Additionally, large areas covered by deposits of Tertiary gravels have been classified MRZ-2b for sand and gravel. A limited amount of aggregate mining has occurred in the Tertiary gravel deposits; however, large-scale mining of these deposits is likely to be more expensive than current instream operations because of higher processing costs. Potential mining operations in these deposits would have to be carefully evaluated to assess the variability of the individual deposit and also the economics of processing and transport; however, many of these deposits are

also potential sources of gold, quartz for silicon manufacture, and clay. Mining of these deposits might be economic if based on the production of two or more commodities.

In eastern Nevada County, areas covered by deposits of younger glacial outwash have been classified MRZ-2a for sand and gravel (ARA-27) and MRZ-2b for sand and gravel (ARA-28, ARA-31). A cinder deposit has been classified MRZ-2a for crushed stone (ARA-30). These areas represent the likely future sources of construction aggregate for eastern Nevada County; however portions of these deposits are already developed and much of the remaining area is near the developing Truckee - Martis Valley area.

In both western and eastern Nevada County, the viability of the identified resources as sources of construction aggregate will depend on the economics of mining and transport relative to existing aggregate mining operations in the county as well as the quality and quantity of material available.

ALTERNATIVE SOURCES OF AGGREGATE

Other than the areas classified MRZ-2a or MRZ-2b for construction aggregate, many areas in Nevada County are classified MRZ-3a or MRZ-3b. Many of these areas might prove suitable as sources of construction aggregate with further evaluation. The metavolcanic rocks of the western county, the volcanic deposits of the eastern county, and the plutonic igneous rocks that occur throughout the county are all potential sources of crushed stone for use as construction aggregate. The older alluvial and glacial deposits of the county are potential sources of sand and gravel. However, all of these deposits would need to be evaluated on a site-specific basis to establish material quality and quantity and the economics of mining and transport.

Alternative sources of construction aggregate for Nevada County also exist outside of the county. Nevada County currently imports construction aggregate into the western portion of the county from Yuba and Placer counties and into the eastern portion of the county from the state of Nevada. It is likely that, as the demand for construction aggregate in Nevada County increases, production of construction aggregate from mines in Nevada County will increase to meet this demand as will imports of aggregate from outside of the county.

CONCLUSIONS

Mineral resource evaluation of Nevada County indicates that five classes of mineral deposits are present, or likely to be present, in sufficient grade and tonnage to be of economic significance within the foreseeable future (50-year period). These are:

1. Deposits formed by hydrothermal process, including gold-quartz veins and polymetallic massive and disseminated sulfide deposits (gold, copper, zinc).

2. Placer deposits (gold).

3. Deposits formed by magmatic segregation (chromite).

4. Industrial minerals formed by diverse processes, including quartz, clay, barite, carbonate rock (limestone), talc, and asbestos.

5. Construction aggregate deposits, including sand and gravel and crushed stone deposits.

A total of 34 separate areas covering about 99 square miles of land in Nevada County are classified MRZ-2 (Areas of Identified Mineral Resource Significance) for the above types of deposits (Plates 2a, 2b, and 2c). The measured area encompassed by each MRZ-2 is presented on Table 6. Note that some of these areas are a composite of more than one MRZ-2.

In terms of immediate economic significance, gold and construction aggregate are probably the most important mineral commodities in Nevada County.

METALLIC MINERAL RESOURCES

Within the county, gold occurs in concentrated form in quartz veins that occupy northerly-trending regional faults and fracture zones, in massive sulfide deposits hosted in Jurassic volcanic rocks, in disseminated sulfide deposits hosted in Paleozoic rocks, and in voluminous placer fluvial deposits of Tertiary age. Although some vein systems and placer localities have been mined extensively, a considerable amount of lode and placer gold is believed to still exist within the county. Consequently, continued exploration and proposed development of

Table 6. Measured areas of land classified MRZ-2, Nevada County

Area	MRZ-2 Index #	Commodity*	Sq Mi**
Mooney Flat	p-2; A-5	Au, S&G	0.37
Spenceville	h-4	Cu, Au, Ag, Zn	0.18
Robinson Ranch	h-5	Cu, Zn	1.79
Waddle Ranch	h-6	Cu, Zn	1.11
Pine Hill	h-7	Au	0.26
North San Juan	A-1	S&G	0.46
Sebastopol	A-10; h-1	Au, S&G	1.01
French Corral	A-9; p-3; i-3	Au, S&G, Si	0.85
Deadman Flat	h-8	Au	5.98
Grass Valley South	h-9	Au	8.41
Grass Valley NE	h-10	Au	2.29
Nevada City	h-11	Au	13.62
San Juan Ridge	A-4,7,12,13; p-1; i-3	Au, S&G, Si	10.27
Blue Tent/Sailor Flat	A-14; p-4; i-3	Au, S&G, Si	1.27
Quaker Hill/You Bet	A-15,17; p-5; i-3	Au, S&G, Si	4.77
Buckeye Ridge	A-16	S&G	0.80
Little York	A-18	S&G	0.26
Bear River-Steephollow Creek	A-2; i-3	S&G	0.47
Bear River/Lake Combie	A-1,8; M-1	S&G, CS	1.43
Democrat Mine	i-2	Ba	0.10
Lowell Hill	A-19; p-7	Au, S&G	1.95
Relief	p-6; i-3	Au, Si	1.22
Washington Trend	h-2,13; i-1	Au, Ag, Cu, Pb, Zn, Ba	16.40
Holbrook Flat Trend	A-20; h-14; p-8; i-3	Au, S&G, Si	8.34
Greenhorn Creek	A-3; i-3	S&G	1.06
Graniteville	h-15	Au	2.16
Graniteville East	h-16	Au	6.44
Meadow Lake	h-3	Au	0.58
Boca Reservoir	G-4	S&G	0.44
Hirschdale	G-3	S&G	0.61
Juniper Flat	V-1	CS	0.13
Martis Valley	G-1,2	S&G	3.29
Gateway	G-5	S&G	0.19
		TOTAL :	**98.51**

TOTAL AREA OF NEVADA COUNTRY = 992 square miles = 10% MRZ-2

* Au = gold (lode and placer), Ag = silver, Cu = copper, Pb = lead, Zn = zinc, Ba = barium, Si= Silicon, S&G = sand and gravel, CS = crushed stone

** Approximate

all types of gold deposits in the county can be expected to continue in the coming years, especially if the price of gold increases. In total, 15 areas covering about 67 square miles and eight areas covering about 22 square miles are classified for lode gold and placer gold, respectively.

Twenty-five known massive sulfide deposits enriched in copper, zinc, and locally gold, hosted in volcanic rocks in the western part of the county have been identified in this report and several of these have been explored by mining companies in recent years and are considered to be of potential economic significance. An attempt is presently being made by one mining company to gain a permit to mine a similar massive sulfide deposit (Western World deposit) located in Yuba County a few miles north of Spenceville. The deposits in Nevada County also represent likely exploration targets for base and precious metal production within the foreseeable future. Three areas covering about 3 square miles are classified MRZ-2 for copper-zinc bearing massive sulfide deposits.

Although chromite deposits mined in Nevada County in the past have been small, it is possible that large, undiscovered, economically significant deposits of chromite may exist. Changes in the chromite market within the foreseeable future could trigger renewed exploration in the Sierra Nevada. No areas are classified MRZ-2 for chromite resources.

INDUSTRIAL MINERAL RESOURCES

Industrial mineral deposits present in economic or potentially economic concentrations in Nevada County include: quartz for the manufacture of silicon; barite; carbonate rock (limestone); clay (kaolinite, illite, and smectite); talc; and asbestos. To date, quartz and barite have had the greatest economic importance among the industrial mineral resources known to occur within the county. It is likely that demand for quartz will increase as producers of silicon continue to search for sources of high-grade source deposits. Two small areas of about 60 acres each are classified for barite while eight areas covering 22 square miles are classified MRZ-2 for quartz resources. No areas are classified MRZ-2 for carbonate rock (limestone), clay, talc, or asbestos resources.

CONSTRUCTION AGGREGATE RESOURCES

Twenty-eight areas covering approximately 23.9 square miles of Nevada County have been classified MRZ-2a or MRZ-2b for construction aggregate resources. This represents approximately 2.4 percent of the area of the county. Of the areas classified MRZ-2a or MRZ-2b for construction aggregate, approximately 19.5

square miles have been identified as Aggregate Resource Areas. An ARA is an area that has been classified MRZ-2a or MRZ-2b for construction aggregate by the State Geologist and is deemed to be available for mining based upon criteria for compatibility provided by the State Mining and Geology Board. This represents approximately 2 percent of the county.

Of the areas identified as ARA's, six deposits (six operators) are currently permitted for aggregate mining within Nevada County and have been identified as Immediately Significant.

ARA-6a	(Desert Gold, Inc. / N. C. Gravel)
ARA-9a	(North Star Rock Products, Inc.)
ARA-13	(Hansen Brothers Enterprises, Inc.)
ARA-20a	(R. J. Miles Company)
ARA-27a	(Teichert Aggregates)
ARA-30a	(Sha-Neva, Inc.)

A seventh aggregate mining operation (two deposits) on the border of Nevada and Placer counties is also identified as Immediately Significant.

ARA-18	(Joe Chevreaux Company)
ARA-19	(Joe Chevreaux Company)

These eight deposits total approximately 1.3 square miles or 0.13 percent of Nevada County.

Eleven areas have been identified as Highly Significant. These areas total approximately 10 square miles or 1 percent of Nevada County. Three of these deposits are identified as Highly Significant due to the large amount of material present. The remaining eight Highly Significant areas are identified as Highly Significant due to proximity to currently permitted aggregate mining operations. An additional eighteen areas have been identified as Significant and total approximately 8.1 square miles or 0.8 percent of Nevada County.

LIFE EXPECTANCY OF CONSTRUCTION AGGREGATE RESERVES

There are currently six permitted aggregate mining operations within Nevada County with combined reserves of 28,560,000 tons. A seventh aggregate mining operation on the border of Nevada and Placer counties reports its production in Placer County and is considered to be in Placer County for the purposes of this report. Greater than one-half of the reserves are located in the eastern part of the county. Annual aggregate production in Nevada County has varied from approximately 700,000 to 1,250,000 tons during the years 1970 to 1988. Nevada County is currently a net importer of construction aggregate and imports

20 percent to 30 percent more aggregate than is produced within the county. Aggregate is imported into the western county from Yuba and Placer counties and into the eastern county from the state of Nevada.

The population in Nevada County is unevenly distributed with approximately 89 percent of the population located in the western part of the county and 11 percent in the eastern part of the county. Due to the uneven distribution of the population of Nevada County and the cost of transporting aggregate, two separate aggregate markets exist - one in the west and one in the east. The population in Nevada County is projected to more than double by the year 2020. If the population of Nevada County increases as projected, the rate of aggregate production within the county as well as the amount of aggregate imported into the county can be expected to increase to meet the increased demands of Nevada County's growing population.

The currently permitted reserves of construction aggregate in western Nevada County are likely to be depleted by the year 2004, 14 years from the time of this study. This number does not account for any replenishment of aggregate at the currently permitted instream mine sites (R. J. Miles Company and Hansen Brothers Enterprises, Inc.). To quantify the replenishment of construction aggregate, which may be substantial, at the currently permitted mine sites, the county may wish to conduct site-specific studies on Greenhorn Creek and on the Bear River. Replenishment may extend the lifespans of reserves at either or both of these two mines by an unknown amount. However, even if replenishment at these sites is significant, constantly increasing aggregate demand will inevitably outstrip reserves in western Nevada County.

The currently permitted reserves of construction aggregate in eastern Nevada County are likely to be depleted by the year 2021, 31 years from the time of this study. Because of the nature of the construction aggregate deposits in eastern Nevada County, the possibility of aggregate replenishment is not an issue there.

The expected longevity of these reserves is based on the assumption that mining will continue to be permitted until the reserves are depleted. To increase the reserve base significantly, the permitting of new mines should be given serious consideration by aggregate producers, local planners and decision-makers. Planning for new mine sites can minimize incompatible adjacent land uses and environmental impacts can be more easily mitigated.

ACKNOWLEDGMENTS

The Division of Mines and Geology gratefully acknowledges the full cooperation of all local government agencies, organizations and mining companies, all of whom provided information or assistance during the course of this study. Special thanks are extended to Patrick Norman of the Nevada County Planning Department; Ralph Phillips of the U.S. Forest Service (retired); Jim Chetney, Terry Mayfield, and Richard Eckenburg of the Nevada Irrigation District; E.L. Hermann and Dallas Childress of the California Department of Transportation; Bill Goss of Hansen Brothers Enterprises, Inc.; Harvey Kreie of R.J. Miles Company; Cliff Block and Rob Wainwright of Teichert Aggregates; Russ Eierman of Desert Gold, Inc. / N.C. Gravel; Harry Abbott of North Star Rock Products, Inc.; Patrick Shane of Sha-Neva, Inc.; Joe Chevreaux of the Joe Chevreaux Company; William Dearman of West River, Inc.; Lowell Robinson of Cal-Sierra Rock Company, Bob Sutherland of Sutherland Construction, Inc.; Ellen Hodos of Onstream Resource Managers,Inc.; Nancy Pease, consulting geologist; Steve Kilbreath, exploration geologist; Dr. R.A. Schweickert of University of Nevada, Reno; Mrs. Roxie Archie of Truckee; and Clyde M. Cole of Sacramento.

A special thanks is also given to the professional and support staff of the Division of Mines and Geology - especially Gary Taylor for research assistance; Dr. Ronald Churchill for geochemical analyses; Roger Chapman, Gordon Chase, Les Youngs, and Elise Mattison for geophysical work; Frances Rubish for drafting; Alison Kenward for editing; and Virginia Williams for word processing.

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APPENDICES

Appendix A. Mines and Prospects Listing and Selected References

Appendix B. California Mineral Land Classification Diagram Nomenclature

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MINES AND PROSPECTS LISTING AND SELECTED REFERENCES

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1	Sierra	asbestos	Washington	17	10	02	Report of the State Mineralogist XVI (1918) pg. 67,132,168; XVII (1920) pg. 434; XXVI (1930) pg. 91; XXXVII (1941) pg. 378.
2	Upper Spanish	barite	Washington	18	11	30	Report of the State Mineralogist XVI (1918) pg. 53,54,94,95; XXXVII (1941) pg. 378.
3	Democrat	barite	Dutch Flat	16	10	24	Report of the State Mineralogist XVI (1918) pg. 71; XVII (1920) pg. 434; XX (1924) pg. 12; XXVI (1930) pg. 53,91; XXXVII (1941) pg. 378,449.
4	Porter	chromite	Grass Valley	16	08	16	Rynearson (1953) pg. 242.
5	Mulcahy	chromite	Grass Valley	16	08	16	Rynearson (1953) pg. 243; Report of the State Mineralogist XXVI (1930) pg. 121.
6	Standard	chromite	Grass Valley	16	08	21	Rynearson (1953) pg. 243.
7	Codd	chromite	Grass Valley	16	08	21	Rynearson (1953) pg. 243; Report of the State Mineralogist XVI (1918).

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8	Holseman	chromite	Grass Valley	16	08	22	Rynearson (1953) pg. 243; Report of the State Mineralogist XVI (1918) pg. 74; XXXVII (1941) pg. 454.
9	Alta Hill	chromite	Grass Valley	16	08	22	Report of the State Mineralogist XVI (1918) pg. 71,92; XX (1924) pg. 10; XXII (1926) pg. 114,119; XXXVII (1941) pg. 444.
10	Grass Valley Ext.	chromite	Grass Valley	16	08	22	Rynearson (1953) pg. 244.
11	Davey	chromite	Grass Valley	16	08	26	Rynearson (1953) pg. 244; Report of the State Mineralogist XVI (1918) pg. 71.
12	Baker	chromite	Grass Valley	16	08	26	Rynearson (1953) pg. 244; Report of the State Mineralogist XVI (1918) pg. 71.
13	Spring Hill	chromite	Grass Valley	16	08	23	Rynearson (1953) pg. 245.
14	Golden Gate	chromite	Grass Valley	16	08	23	Rynearson (1953) pg. 245; Report of the State Mineralogist XVI (1918) pg. 73.

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15	Geach	chromite	Grass Valley	16	08	25	Rynearson (1953) pg. 245; Report of the State Mineralogist XVI (1918) pg. 72.
16	Section 19	chromite	Grass Valley	16	08	19	Rynearson (1953) pg. 245.
17	Dorsey and Ridge	chromite	Grass Valley	15	08	06	Rynearson (1953) pg. 247; Report of the State Mineralogist XVI (1918) pg. 72; XXXVII (1941) pg. 449.
18	Prospect	chromite	Grass Valley	15	08	05	----------
19	Dickerson	chromite	Grass Valley	15	08	04	Rynearson (1953) pg. 247; Report of the State Mineralogist XVI (1918) pg. 72; XXXVII (1941) pg. 449.
20	Bowden	chromite	Grass Valley	15	08	03	Rynearson (1953) pg. 247.
21	Shrull	chromite	Chicago Park	15	09	17	Rynearson (1953) pg. 246.
22	Numitor	chromite	Chicago Park	15	09	14	Rynearson (1953) pg. 246.
23	Schmidt	chromite	Chicago Park	15	09	21	Rynearson (1953) pg. 246.
24	Weisgien	chromite	Chicago Park	15	09	21	Rynearson (1953) pg. 247.
25	Rolpholm	chromite	Chicago Park	15	09	28	Rynearson (1953) pg. 247.

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
26	Sleeman	chromite	Limekiln Rd	15	08	32	Rynearson (1953) pg. 234.
27	Thompson	chromite	Limekiln Rd	14	08	05	Rynearson (1953) pg. 247.
28	Sweet Ranch	chromite	Limekiln Rd	14	08	04	Rynearson (1953) pg. 248.
29	Half Chrome	chromite	Limekiln Rd	14	08	04	Rynearson (1953) pg. 248.
30	Tomkin	chromite	Limekiln Rd	14	08	09	Rynearson (1953) pg. 249.
31	Williamson & Cole	chromite	Washington	18	10	25	Rynearson (1953) pg. 235.
32	Moscatelli No. 2	chromite	Washington	18	10	36	Rynearson (1953) pg. 236.
33	Gillis	chromite	Washington	17	10	01	Rynearson (1953) pg. 236.
34	Flintlock	chromite	Washington	17	10	01	Rynearson (1953) pg. 236.
35	Moscatelli No. 1	chromite	Washington	17	10	01	Rynearson (1953) pg. 236.
36	Turtledove	chromite	Washington	17	10	01	Rynearson (1953) pg. 237.
37	Rapid Fire	chromite	Washington	17	10	01	Rynearson (1953) pg. 237.
38	Red Ledge	chromite	Washington	17	10	13	Rynearson (1953) pg. 237; Report of the State Mineralogist XVI (1918) pg. 77,78.
39	Victory	chromite	Washington	17	10	24	Rynearson (1953) pg. 240.

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40	Olsen	chromite	Washington	17	10	24	Rynearson (1953) pg. 240.
41	Bartholomew-Simms	chromite	Lowell Hill	16	11	07	Rynearson (1953) pg. 240.
42	Maguire	chromite	Lowell Hill	16	11	08	Rynearson (1953) pg. 240.
43	San Juan	gold	Northwest County	17	07	12	Bulletin 92 (1923) pg. 119; Report of the State Mineralogist XI (1892) pg. 265; XXXVII (1941) pg. 463.
44	Red Ledge	copper-zinc	Northwest County	17	07	36	Bulletin 50 (1908) pg. 200; Report of the State Mineralogist XVI (1918) pg. 89,239,248; XVII (1920) pg. 438; XXVI (1930) pg. 95; XXXVII (1941) pg. 462.
45	Peacock	copper-zinc	West County	16	06	25	Unpublished Company (Nevcan) data.
46	Iron Clad	gold	West County	16	07	26	----------
47	Taylor Iron Mtn.	copper-zinc	West County	15	07	04	Report of the State Mineralogist XVI (1918) pg. 262.
48	Robinson Ranch West	copper-zinc	West County	15	07	05	Unpublished Company (Nevcan) data.
49	Robinson Ranch East	copper-zinc	West County	15	07	04	Unpublished Company (Nevcan) data.
50	Southern Oaks	copper-zinc	West County	15	07	07	Unpublished Company (Nevcan) data.

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51	Spenceville North	copper-zinc	West County	15	06	23	Unpublished Company (Nevcan) data.
52	Spenceville	copper-zinc	West County	15	06	26	Bulletin 23 (1902) pg. 163; Bulletin 50 (1908) pg. 191; Report of the State Mineralogist IV (1884) pg. 151; X (1890) pg. 392; XI (1892) pg. 313; XXVI (1930) pg. 95.
53	Daniels	copper-zinc	West County	15	08	29	Unpublished Company (Nevcan) data.
54	Waddle Iron Mountain	copper-zinc	West County	15	07	34	Unpublished Company (Nevcan) data.
55	Orchard East	copper-zinc	West County	14	07	06	Unpublished Company (Nevcan) data.
56	Orchard West	copper-zinc	West County	14	06	12	Unpublished Company (Nevcan) data.
57	Rock Creek	copper-zinc	West County	14	07	09	Unpublished Company (Nevcan) data.
58	Pine Hill	lode gold	West County	14	07	12	Bulletin 50 (1908) pg. 199; Bulletin 99 (1928) pg. 137; Preliminary Report 7, pg. 65; Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XVI (1918) pg. 88; XXXVII (1941) pg. 461.
59	Prospect	copper-zinc	West County	14	07	13	----------

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60	Prospect	copper-zinc	West County	14	07	19	Bulletin 23 (1902) pg. 166.
61	Prospect	copper-zinc	West County	14	07	30	Bulletin 23 (1902) pg. 166.
62	Hibbner	copper-zinc	West County	14	07	32	Bulletin 23 (1902) pg. 167.
63	Live Oak	copper-zinc	West County	14	07	26	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XI (1892) pg. 297; XII (1894) pg. 191; XIII (1896) pg. 250; XXXVII (1941) pg. 456.
64	Cedar	copper-zinc	West County	14	08	20	Report of the State Mineralogist XII (1894) pg. 186; XVI (1918) pg. 134.
65	Prospect	copper-zinc	West County	14	08	29	Unpublished Company (Nevcan) data.
66	Gautier Ranch	copper-zinc	West County	14	08	28	Bulletin 50 (1908) pg. 203; Report of the State Mineralogist XVI (1918) pg. 86; XXXVII (1941) pg. 451.
67	Spanish	lode gold	Washington	18	11	30	See Upper Spanish No. 2.
68	Spanish West	lode gold	Washington	18	11	30	See Upper Spanish No. 2.

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
69	Champion	copper-zinc	West County	15	06	12	Report of the State Mineralogist XVI (1918) pg. 39,135; XX (1924) pg. 357; XXVI (1930) pg. 103,128; XXXVII (1941) pg. 447.
70	Eureka	copper-zinc	West County	15	06	12	Report of the State Mineralogist II (1882) pg. 175; XI (1892) pg. 268; XVI (1918) pg. 15.
71	Last Chance	copper-zinc	West County	15	06	12	Bulletin 38 (1906) pg. 218; Bulletin 50 (1908) pg. 196; Register of Mines (Nevada) pg. 6,10; Report of the State Mineralogist VIII (1888) pg. 458; XIII (1896) pg. 250; XVI (1918) pg. 86,193; XXXVII (1941) pg. 456.
72	Arkansas Traveler	copper-zinc	West County	15	06	13	Bulletin 23 (1902) pg. 167; Bulletin 50 (1908) pg. 197; Report of the State Mineralogist XVI (1918) pg. 81; XXXVII (1941) pg. 444.
73	Lutan	copper	West County	14	07	02	Report of the State Mineralogist XXXVII (1941) plate 3.

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74	Slide	lode gold	Northwest County	17	07	36	Report of the State Mineralogist XXXVII (1941) pg. 464.
75	Buelow	lode gold	Northwest County	17	07	36	----------
76	Empress	lode gold	Deadman's Flat	16	08	17	Report of the State Mineralogist XXVII (1931) pg. 298; XXXI (1935) pg. 13; XXXVII (1941) pg. 397,450.
77	Kentucky Ridge	lode gold	Deadman's Flat	16	07	13	Report of the State Mineralogist XXXVII (1941) pg. 455.
78	Black Bear	lode gold	Deadman's Flat	16	07	13	Report of the State Mineralogist XVI (1918) pg. 122; XXXI (1935) pg. 11; XXXVII (1941) pg. 386,445.
79	Niagra (West)	lode gold	Deadman's Flat	16	08	18	Report of the State Mineralogist XXXVII (1941) plate 3.
80	Niagra (East)	lode gold	Deadman's Flat	16	08	18	Report of the State Mineralogist XXXVII (1941) plate 3.
81	Mystery	lode gold	Deadman's Flat	16	08	19	Report of the State Mineralogist XXVI (1930) pg. 119; XXXVII (1941) pg. 458.

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82	Mistletoe	lode gold	Deadman's Flat	16	07	23	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XII (1894) pg. 193; XIII (1896) pg. 253; XVI (1918) pg. 198; XXXVII (1941) pg. 457.
83	Baltic	lode gold	Deadman's Flat	16	08	30	Register of Mines (Nevada) pg. 9,10; Report of the State Mineralogist VIII (1888) pg. 451; XII (1894) pg. 185; XIII (1896) pg. 235; XVI (1918) pg. 119; XXXVII (1941) pg. 444.
84	Gold Mound	lode gold	Deadman's Flat	16	08	29	Report of the State Mineralogist XVI (1918) pg. 174; XXXVII (1941) pg. 452.
85	Prospect	lode gold	Deadman's Flat	16	08	30	----------
86	Osceola	lode gold	Deadman's Flat	16	08	30	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XII (1894) pg. 198; XIII (1896) pg. 259; XVI (1918) pg. 227; XVIII (1922) pg. 142; XXIII (1927) pg. 194; XXXVII (1941) pg. 461.

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87	South Star	lode gold	Deadman's Flat	16	08	30	Report of the State Mineralogist XVI (1918) pg. 247,248; XXXI (1935) pg. 16; XXXVII (1941) pg. 464.
88	Prospect	lode gold	Deadman's Flat	16	08	29	----------
89	Last Chance	lode gold	Deadman's Flat	16	08	32	----------
90	MacDonald	lode gold	Deadman's Flat	16	08	31	Report of the State Mineralogist XXXVII (1941) plate 3.
91	Pittsburg	lode gold	Deadman's Flat	16	08	31	Report of the State Mineralogist XVI (1918) pg. 130,257.
92	Vulcan-Grey Eagle	lode gold	Deadman's Flat	16	08	31	Report of the State Mineralogist XVI (1918) pg. 256.
93	Normandy-Dulmaine	lode gold	Deadman's Flat	16	08	32	Report of the State Mineralogist XVI (1918) pg. 208; XVII (1920) pg. 437; XXXVII (1941) pg. 426,459; Preliminary Report 8 (1921) pg. 31.
94	Prospect	lode gold	Deadman's Flat	15	08	05	----------

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95	Alcalde	lode gold	Deadman's Flat	15	08	05	Report of the State Mineralogist XVI (1918) pg. 111; XVII (1920) pg. 435; XVIII (1922) pg. 139,738; XXVI (1930) pg. 101; XXXI (1935) pg. 16; XXXVII (1941) pg. 381,444.
96	Stanford	lode gold	Deadman's Flat	15	08	05	Register of Mines (Nevada) pg. 8,11; Report of the State Mineralogist XII (1894) pg. 264.
97	Belle of France	lode gold	Deadman's Flat	15	08	03	Report of the State Mineralogist XXXVII (1941) pg. 385,445.
98	Prospect	lode gold	Deadman's Flat	15	08	09	Report of the State Mineralogist XXXVII (1941) plate 3.
99	Mascot	lode gold	Deadman's Flat	15	08	16	Report of the State Mineralogist XXXVII (1941) pg. 457.
100	Chester Butler	lode gold	Deadman's Flat	14	08	05	Report of the State Mineralogist XXXVII (1941) pg. 390.
101	Stockton Hill	lode gold	Deadman's Flat	14	08	09	Register of Mines (Nevada) pg. 8. Report of the State Mineralogist XXXVII (1941) pg. 429.
102	Mayben Hill	lode gold	Deadman's Flat	14	08	16	Report of the State Mineralogist XXXVII (1941) pg. 425.

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103	Fort Knox	lode gold	Nevada City West	17	08	28	Report of the State Mineralogist XXXVII (1941) plate 3.
104	Standard	lode gold	Nevada City West	17	08	34	Report of the State Mineralogist XXXI (1935) pg. 16; XXXVII (1941) pg. 464.
105	Aetna Ledge	lode gold	Nevada City West	16	08	04	Report of the State Mineralogist XXXVII (1941) plate 3.
106	Homestake	lode gold	Nevada City West	17	08	35	Report of the State Mineralogist XXXVII (1941) pg. 454.
107	Ragoon	lode gold	Nevada City West	16	08	02	Report of the State Mineralogist XXXVII (1941) pg. 453.
108	Forest	lode gold	Nevada City West	16	08	03	Report of the State Mineralogist XIII (1896) pg. 243; XXXVII (1941) pg. 451.
109	Mt. Auburn	lode gold	Nevada City West	16	08	02	Report of the State Mineralogist XIII (1896) pg. 254; XVI (1918) pg. 202; XXXVII (1941) pg. 458.
110	Kirkham	lode gold	Nevada City West	16	08	02	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XIII (1896) pg. 249; XXXVII (1941) pg. 455.

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111	Coan	lode gold	Nevada City West	16	08	03	Register of Mines (Nevada) pg. 4,10; Report of the State Mineralogist XIII (1896) pg. 239; XVI (1918) pg. 143; XXXVII (1941) pg. 448.
112	Spanish	lode gold	Nevada City West	16	08	02	Register of Mines (Nevada) pg. 8,11; Report of the State Mineralogist VI (1886) pg. 51; VIII (1888) pg. 429,442,444; XI (1892) pg. 291,293; XII (1894) pg. 200; XIII (1896) pg. 264; XVII (1920) pg. 249; XXXVII (1941) pg. 428,464.
113	Mt. George	lode gold	Nevada City West	16	08	10	Register of Mines (Nevada) pg. 6,11; Report of the State Mineralogist XII (1894) pg. 193,254; XXXVII (1941) pg. 458.
114	New Nevada City	lode gold	Nevada City West	16	08	11	Register of Mines (Nevada) pg. 7,10; Report of the State Mineralogist VI (1886) pg. 4,49; VIII (1888) pg. 418; XI (1892) pg. 286,288; XXXVII (1941) pg. 459.
115	Old Nevada City	lode gold	Nevada City West	16	08	11	See New Nevada City No. 114.

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116	Orleans	lode gold	Nevada City West	16	08	11	Register of Mines (Nevada) pg. 10; Report of the State Mineralogist VIII (1888) pg. 432; XIII (1896) pg. 258; XVI (1918) pg. 226; XXXVII (1941) pg. 461.
117	Red Hill	lode gold	Nevada City West	16	08	11	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XXXVII (1941) pg. 462.
118	Old Champion	lode gold	Nevada City West	16	08	11	See Champion No. 123.
119	Merrifield	lode gold	Nevada City West	16	08	12	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist VIII (1888) pg. 423; XI (1892) pg. 286; XXXVII (1941) pg. 457.
120	Gold Tunnel	lode gold	Nevada City West	16	08	12	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XXXVII (1941) pg. 388,452.
121	Wyoming	lode gold	Nevada City West	16	08	11	Report of the State Mineralogist XI (1892) pg. 286,291; XIII (1896) pg. 239,267; XXXVII (1941) pg. 468.

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122	Mountaineer	lode gold	Nevada City West	16	08	12	Register of Mines (Nevada) pg. 6,10; Report of the State Mineralogist X (1890) pg. 384; XI (1892) pg. 287; XII (1894) pg. 193; XIII (1896) pg. 254; XVI (1918) pg. 200; XXXVII (1941) pg. 458.
123	Champion	lode gold	Nevada City West	16	08	11	Register of Mines (Nevada) pg. 7,11; Report of the State Mineralogist VI (1886) pg. 47; VIII (1888) pg. 418; XI (1892) pg. 286,290; XII (1894) pg. 198; XIII (1896) pg. 260; XVI (1918) pg. 39; XXXVII (1941) pg. 39,462.
124	Providence	lode gold	Nevada City West	16	08	12	See Champion No. 123.
125	Cadmus	lode gold	Nevada City West	16	08	11	Register of Mines (Nevada) pg. 4,10; Report of the State Mineralogist XIII (1896) pg. 237; XVI (1918) pg. 135; XXXVII (1941) pg. 446.
126	New Shaft	lode gold	Nevada City West	16	08	13	Report of the State Mineralogist XXXVII (1941) plate 3.

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127	California	lode gold	Nevada City West	16	08	12	Bulletin 50 (1908) pg. 203; Register of Mines (Nevada) pg. 4,10; Report of the State Mineralogist VIII (1888) pg. 448; XIII (1896) pg. 238; XVI (1918) pg. 84; XVIII (1922) pg.45; XXXVII (1941) pg. 446.
128	Half-Mile House	lode gold	Nevada City West	16	08	13	Report of the State Mineralogist XXXVII (1941) plate 3.
129	Reward	lode gold	Nevada City West	16	08	13	Register of Mines (Nevada) pg. 7,11; Report of the State Mineralogist XII (1894) pg. 199; XIII (1896) pg. 262; XXXVII (1941) pg. 428, 463.
130	Crosby	lode gold	Nevada City West	16	08	13	Report of the State Mineralogist XXXVII (1941) plate 3.
131	Fortuna	lode gold	Nevada City West	16	08	13	Report of the State Mineralogist XIII (1896) pg. 265; XVI (1918) pg. 200; XXXVII (1941) pg. 451.

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132	Orleans	lode gold	Nevada City West	16	08	13	Register of Mines (Nevada) pg. 10; Report of the State Mineralogist VIII (1888) pg. 432; XIII (1896) pg. 258; XVI (1918) pg. 226; XXXVII (1941) pg. 461.
133	Orleans West	lode gold	Nevada City West	16	09	18	See Orleans No. 132.
134	Sneath & Clay	lode gold	Nevada City West	16	09	18	Register of Mines (Nevada) pg. 8; Report of the State Mineralogist XVI (1918) pg. 234; XXXVII (1941) pg. 461.
135	Thomas	lode gold	Nevada City West	16	08	13	Report of the State Mineralogist XXXVII (1941) pg. 465.
136	Mohigan	lode gold	Nevada City West	16	08	13	Report of the State Mineralogist XII (1894) pg. 189; XIII (1896) pg. 253; XVI (1918) pg. 198; XXXVII (1941) pg. 458.
137	Gold Flat	lode gold	Nevada City West	16	08	13	See Mohigan No. 136.

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
138	Pittsburg	lode gold	Nevada City West	16	09	18	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XII (1894) pg. 189; XIII (1896) pg. 245; XVI (1918) pg. 234; XXXVII (1941) pg. 461.
139	Eureka	lode gold	Nevada City West	16	09	18	Register of Mines (Nevada) pg. 5; Report of State Mineralogist XVI (1918) pg. 166; XXXVII (1941) pg. 450.
140	Morning Star	lode gold	Nevada City West	16	09	18	Report of the State Mineralogist XXXVII (1941) pg. 458.
141	Manhattan	lode gold	Nevada City West	16	09	18	Report of the State Mineralogist XXXVII (1941) pg. 457.
142	Gracie	lode gold	Nevada City West	16	09	18	Report of the State Mineralogist XVI (1918) pg. 183; XXVI (1930) pg. 113; XXXVII (1941) pg. 452.
143	Chicago	lode gold	Nevada City West	16	09	18	Report of the State Mineralogist XXXVII (1941) pg. 448.
144	Potosie	lode gold	Nevada City West	16	09	24	See Pittsburg No. 138.

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
145	Success	lode gold	Nevada City West	16	09	19	Report of the State Mineralogist XXXVII (1941) plate 3.
146	Merrimac	lode gold	Nevada City West	16	08	24	Report of the State Mineralogist XI (1892) pg. 268; XII (1894) pg. 193; XIII (1896) pg. 253; XVI (1918) pg. 197; XXXVII (1941) pg. 457.
147	Washington	lode gold	Nevada City West	16	09	19	Report of the State Mineralogist XVI (1918) pg. 257; XXXVII (1941) pg. 467.
148	Davis	lode gold	Nevada City East	17	09	32	Report of the State Mineralogist XXXVII (1941) plate 3.
149	Jackson	lode gold	Nevada City East	17	09	32	Bulletin 50 (1908) pg. 197; Register of Mines (Nevada) pg. 11; Report of the State Mineralogist XIII (1896) pg. 60; XXXVII (1941) pg. 385.
150	Hoge	lode gold	Nevada City East	7	09	32	Report of the State Mineralogist XXVII (1931) pg. 298; XXXI (1935) pg. 15; XXXVII (1941) pg. 402,453.

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151	Willow Valley	lode gold	Nevada City East	16	09	04	Register of Mines (Nevada) pg. 8; Report of the State Mineralogist XIII (1896) pg. 267; XXXVII (1941) pg. 467.
152	Hussey	lode gold	Nevada City East	16	09	04	Report of the State Mineralogist XXXVII (1941) pg. 454.
153	Montana	lode gold	Nevada City East	16	09	04	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XIII (1896) pg. 254; XXXVII (1941) pg. 458.
154	Texas	lode gold	Nevada City East	16	09	08	Register of Mines (Nevada) pg. 8; Report of the State Mineralogist XVI (1918) pg. 253; XXXVII (1941) pg. 465.
155	Deadwood	lode gold	Nevada City East	16	09	09	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XIII (1896) pg. 240; XVI (1918) pg. 150; XXXVII (1941) pg. 449.
156	St. Louis	lode gold	Nevada City East	16	09	09	Report of the State Mineralogist XIII (1896) pg. 235.

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157	Never Sweat	lode gold	Nevada City East	16	09	09	Register of Mines (Nevada) pg. i; Report of the State Mineralogist XIII (1896) pg. 256; XVI (1918) pg. 205; XVII (1920) pg. 438; XXXVII (1941) pg. 459.
158	Belfontain	lode gold	Nevada City East	16	09	09	Report of the State Mineralogist XXXVII (1941) plate 3.
159	Federal Loan	lode gold	Nevada City East	16	09	10	Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist XI (1892) pg. 286,290; XII (1894) pg. 189; XIII (1896) pg. 243; XVI (1918) pg. 169; XXXVII (1941) pg. 385,451; U.S. Geological Survey Folio No. 29.
160	Murchie	lode gold	Nevada City	16	09	08	Report of the State Mineralogist XIII (1896) pg. 250; XVI (1918) pg. 202; XXVI (1930) pg. 118; XXVII (1931) pg. 298; XXXI (1935) pg. 13; XXXVII (1941) pg. 380,458.

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161	Alice Bell	lode gold	Nevada City East	16	09	08	Report of the State Mineralogist XXXVII (1941) plate 3.
162	Kingsbury	lode gold	Nevada City East	16	09	08	Report of the State Mineralogist XXXVII (1941) plate 3.
163	Alpine	lode gold	Nevada City East	16	09	17	See St. Louis No. 156.
164	Canada Hill	lode gold	Nevada City East	16	09	17	Report of the State Mineralogist XXXI (1935) pg. 11; XXXVII (1941) pg. 388.
165	Grant	lode gold	Nevada City East	16	09	17	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XVI (1918) pg. 183; XXXVII (1941) pg. 389,452.
166	Union	lode gold	Nevada City East	16	09	16	Register of Mines (Nevada) pg. 8; Report of the State Mineralogist XVI (1918) pg. 254,263; XXXVII (1941) pg. 315,443,466; XXXVIII (1942) pg. 340.
167	North Banner	lode gold	Nevada City East	16	09	16	See Banner No. 168.

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168	Banner	lode gold	Nevada City East	16	09	16	Report of the State Mineralogist XX (1924) pg. 9; XXVI (1930) pg. 10; XXXVII (1941) pg. 445.
169	British American	lode gold	Nevada City East	16	09	22	Report of the State Mineralogist XXXVII (1941) plate 3.
170	Lava Cap	lode gold	Nevada City East	16	09	28	Report of the State Mineralogist XXXVII (1941) pg. 456; XXXVIII (1942) pg. 341.
171	St. John	lode gold	Grass Valley NE	16	08	22	Register of Mines (Nevada) pg. 8; Report of the State Mineralogist XI (1892) pg. 281,282; XII (1894) pg. 201; XIII (1896) pg. 265; XIX (1923) pg. 140; XXXVII (1941) pg. 465.
172	Coe	lode gold	Grass Valley NE	16	08	26	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist X (1890) pg. 384; XVI (1918) pg. 144; XXXVII (1941) pg. 448.

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173	Powning	lode gold	Grass Valley NE	16	08	26	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XVI (1918) pg. 237; XXXVII (1941) pg. 462.
174	Eureka	lode gold	Grass Valley NE	16	08	26	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XVI (1918) pg. 166; XXXVII (1941) pg. 450.
175	Crown Point	lode gold	Grass Valley NE	16	08	26	Report of the State Mineralogist VII (1887) pg. 429,693; XIII (1896) pg. 239; XVI (1918) pg. 149; XXXVII (1941) pg. 390,448.
176	Spring Hill	lode gold	Grass Valley NE	16	08	23	Register of Mines (Nevada) pg. 8; Report of the State Mineralogist VIII (1888) pg. 434; XXXI (1935) pg. 16; XXXVII (1941) pg. 430,464.
177	Alpha	lode gold	Grass Valley NE	16	08	24	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XVI (1918) pg. 116; XXXVII (1941) pg. 444.

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178	Idaho	lode gold	Grass Valley NE	16	08	25, 26	Report of the State Mineralogist XVI (1918) pg. 185; XVII (1920) pg. 436; XIX (1923) pg. 73; XXVI (1930) pg. 114; XXVII (1931) pg. 298; XXXI (1935) pg. 15; XXXVII (1941) pg. 454; Preliminary Report 8, pg. 31.
179	Maryland	lode gold	Grass Valley NE	16	08	26	See Idaho No. 178.
180	Maslin	lode gold	Grass Valley NE	16	08	25	Report of the State Mineralogist XXXVII (1941) plate 3.
181	Old Brunswick	lode gold	Grass Valley NE	16	08	25	Register of Mines (Nevada) pg. 4,10; Report of the State Mineralogist VIII (1888) pg. 431,693; X (1890) pg. 381; XI (1892) pg. 268,274; XII (1894) pg. 186; XIII (1896) pg. 237,269; XVI (1918) pg. 124; XX (1924) pg. 9; XXXI (1935) pg. 11; XXXVII (1941) pg. 446.
182	Gold Point	lode gold	Grass Valley NE	16	08	25	Report of the State Mineralogist XVI (1918) pg. 176.

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
183	Cheyenne	lode gold	Grass Valley NE	16	08	25	Report of the State Mineralogist XVIII (1922) pg. 143.
184	Union	lode gold	Grass Valley NE	16	08	36	Report of the State Mineralogist VIII (1888) pg. 419; XII (1894) pg. 201; XIII (1896) pg. 265,266; XVI (1918) pg. 99,254; XVII (1920) pg. 439; XXXVII (1941) pg. 466.
185	New Brunswick	lode gold	Grass Valley NE	16	09	31	See Old Brunswick No. 181.
186	Republic	lode gold	Grass Valley NE	15	09	06	----------
187	Jack Rabbit	lode gold	Grass Valley NE	15	09	05	Report of the State Mineralogist XII (1894) pg. 190; XIII (1896) pg. 248; XXXVII (1941) pg. 455.
188	Scotia	lode gold	Grass Valley South	16	08	27	Report of the State Mineralogist XVI (1918) pg. 244; XXXVII (1941) pg. 463.
189	Boundary	lode gold	Grass Valley South	16	08	27	Report of the State Mineralogist XXXVII (1941) pg. 387,446.

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190	Peabody	lode gold	Grass Valley South	16	08	27	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XI (1892) pg. 268,275; XII (1894) pg. 198; XIII (1896) pg. 260; XVI (1918) pg. 229; XXXVII (1941) pg. 461.
191	Minnie	lode gold	Grass Valley South	16	08	27	Report of the State Mineralogist XXXVIII (1942) pg. 463.
192	Hermosa	lode gold	Grass Valley South	16	08	33	Report of the State Mineralogist XI (1892) pg. 280; XXXVII (1941) pg. 453.
193	Scadden	lode gold	Grass Valley South	16	08	34	Report of the State Mineralogist XXXVII (1941) pg. 463.
194	Rocky Bar	lode gold	Grass Valley South	16	08	34	Report of the State Mineralogist VIII (1888) pg. 433; XII (1894) pg. 199,200; XIII (1896) pg. 262; XXXVII (1941) pg. 463.
195	Wyoming	lode gold	Grass Valley South	16	08	34	Report of the State Mineralogist XI (1892) pg. 286,291; XIII (1896) pg. 239,267; XXXVII (1941) pg. 468.
196	Granite Hill	lode gold	Grass Valley South	16	08	34	See North Star No. 202.

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197	Hudson Bay	lode gold	Grass Valley South	16	08	33	Report of the State Mineralogist XI (1892) pg. 268,282; XXXVII (1941) pg. 454.
198	North Star Central	lode gold	Grass Valley South	16	08	34	See North Star No. 202.
199	Larimer	lode gold	Grass Valley South	16	08	34	See North Star No. 202.
200	Granger	lode gold	Grass Valley South	16	08	33	Report of the State Mineralogist XXXVII (1941) plate 3.
201	New York Hill	lode gold	Grass Valley South	15	08	03	Report of the State Mineralogist XI (1892) pg. 268; XXXVII (1941) pg. 459.
202	North Star	lode gold	Grass Valley South	15	08	03	Register of Mines (Nevada) pg. 7,10; Report of the State Mineralogist VI (1886) pg. 44; VIII (1888) pg. 428; X (1890) pg. 376; XI (1892) pg. 268; XII (1894) pg. 195; XIII (1896) pg. 257; XVI (1918) pg. 211; XVII (1920) pg. 437; XXVI (1930) pg. 121; XXVIII (1932) pg. 298; XXXVII (1941) pg. 380,460.

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203	East Star	lode gold	Grass Valley South	15	08	03	Report of the State Mineralogist XXXVII (1941) pg. 450.
204	Omaha	lode gold	Grass Valley South	15	08	02	Register of Mines (Nevada) pg. 7,10; Report of the State Mineralogist VIII (1888) pg. 433,693; X (1890) pg. 373; XI (1892) pg. 268,373; XII (1894) pg. 197; XIII (1896) pg. 258.
205	Lone Jack	lode gold	Grass Valley South	15	08	02	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XI (1892) pg. 273; XXXVII (1941) pg. 456.
206	Wisconsin	lode gold	Grass Valley South	15	08	03	Report of the State Mineralogist XIII (1896) pg. 267; XXXVII (1941) pg. 467.
207	New Homeward Bound	lode gold	Grass Valley South	15	08	02	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist X (1890) pg. 582; XXXVII (1941) pg. 454.
208	Old Homeward Bound	lode gold	Grass Valley South	15	08	02	See New Homeward Bound No. 207.

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209	Hartery	lode gold	Grass Valley South	15	08	02	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist X (1890) pg. 379; XI (1892) pg. 283; XVI (1918) pg. 184; XXXVII (1941) pg. 453.
210	Surprise	lode gold	Grass Valley South	15	08	02	Report of the State Mineralogist XXXVII (1941) plate 3.
211	Old Allison Ranch	lode gold	Grass Valley South	15	08	02	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XI (1892) pg. 268; XVI (1918) pg. 112; XVII (1920) pg. 435; XIX (1923) pg. 74.
212	Phoenix	lode gold	Grass Valley South	15	08	03	Report of the State Mineralogist XVI (1918) pg. 234; XXXVII (1941) pg. 461.
213	Buena Vista/Eclispe	lode gold	Grass Valley South	15	08	02	Report of the State Mineralogist XVI (1918) pg. 128; XXXVII (1941) pg. 387,446.
214	Bell Union	lode gold	Grass Valley South	15	08	11	Report of the State Mineralogist XVI (1918) pg. 120; XXXVII (1941) pg. 445.

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215	Amador Con	lode gold	Grass Valley South	15	08	11	Report of the State Mineralogist XXXVII (1941) pg. 382.
216	Norambugua Group	lode gold	Grass Valley South	15	08	11	Report of the State Mineralogist XIII (1896) pg. 256; XVI (1918) pg. 207; XVII (1920) pg. 436; XVIII (1922) pg. 7; XXXVII (1941) pg. 459.
217	Howe	lode gold	Grass Valley South	15	08	11	Report of the State Mineralogist XXXVII (1941) plate 3.
218	Pennsylvania	lode gold	Grass Valley South	16	08	34	Register of Mines (Nevada) pg. 7,11; Report of the State Mineralogist X (1890) pg. 383; XI (1892) pg. 268,276; XIII (1896) pg. 260; XVI (1918) pg. 230; XXXVII (1941) pg. 380,461.
219	Telegraph	lode gold	Grass Valley South	16	08	35	Report of the State Mineralogist XI (1892) pg. 283; XXXVII (1941) pg. 465.
220	Magenta	lode gold	Grass Valley South	16	08	35	Report of the State Mineralogist XI (1892) pg. 273; XXXVII (1941) pg. 457.

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221	Golden Treasure	lode gold	Grass Valley South	16	08	35	Report of the State Mineralogist XXXVII (1941) plate 3.
222	Empire	lode gold	Grass Valley South	16	08	35	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist VI (1886) pg. 46; XI (1892) pg. 268; XII (1894) pg. 189; XIII (1896) pg. 242; XVI (1918) pg. 154; XVII (1920) pg. 436; XVIII (1922) pg. 140,737; XX (1924) pg. 10; XXVI (1926) pg. 152; XXVI (1930) pg. 105; XXVIII (1932) pg. 443,450; XXXVIII (1942) pg. 340.
223	Rich Hill	lode gold	Grass Valley South	16	08	35	Report of the State Mineralogist XXXVII (1941) plate 3.
224	Orleans	lode gold	Grass Valley South	16	08	35	Register of Mines (Nevada) pg. 10; Report of the State Mineralogist VIII (1888) pg. 432; XIII (1896) pg. 258; XVI (1918) pg. 226; XXXVII (1941) pg. 461.

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225	Heuston	lode gold	Grass Valley South	16	08	35	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XXXVII (1941) pg. 453.
226	New Ophir	lode gold	Grass Valley South	16	08	35	Report of the State Mineralogist XVI (1918) pg. 206; XXXVII (1941) pg. 459.
227	Prescott	lode gold	Grass Valley South	16	08	35	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XXXVII (1941) pg. 462.
228	Sebastopol	lode gold	Grass Valley South	16	08	35	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XIII (1896) pg. 263; XXXVII (1941) pg. 463.
229	Betsy	lode gold	Grass Valley South	16	08	35	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XVI (1918) pg. 250; XXXVII (1941) pg. 445.
230	Koan	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XXXVII (1941) plate 3.
231	King Hill	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XXXVII (1941) pg. 455.

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232	Big Diamond	lode gold	Grass Valley South	15	08	02	Report of the State Mineralogist XXXVII (1941) plate 3.
233	Sultana	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XVI (1918) pg. 134,146,250.
234	Osborne	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XII (1894) pg. 198.
235	Conlan	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XII (1894) pg. 187; XIII (1896) pg. 239.
236	Centennial	lode gold	Grass Valley South	15	08	01	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XI (1892) pg. 280; XII (1894) pg. 184; XIII (1896) pg. 238; XXXVII (1941) pg. 390,447.
237	Bullion	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XIII (1896) pg. 237,271; XVI (1918) pg. 128; XXXI (1935) pg. 11.
238	Lafayette	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XI (1892) pg. 283; XXXVII (1941) pg. 455.

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239	Comet	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XXXVII (1941) pg. 448.
240	Franklin	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XXXVII (1941) pg. 451.
241	Alaska	lode gold	Grass Valley South	15	08	01	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XVI (1918) pg. 109; XXXVII (1941) pg. 380,444.
242	Oakland	lode gold	Grass Valley South	15	08	01	Report of the State Mineralogist XXXVII (1941) pg. 427,460.
243	Goodall Tunnel	lode gold	Grass Valley South	15	08	01	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XIII (1896) pg. 246; XVI (1918) pg. 182; XXXVII (1941) pg. 452.
244	Grizzly	lode gold	Foote Crossing	18	09	20	Bulletin 50 (1908) pg. 204; Report of the State Mineralogist XI (1892) pg. 307; XVI (1918) pg. 85; XXXVII (1941) pg. 453.

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245	Delhi-St. Gothard	lode gold	Foote Crossing	18	09	21	Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist VIII (1888) pg. 444,693; XI (1892) pg. 305; XII (1894) pg. 188; XIII (1896) pg. 241; XVI (1918) pg. 147; XVII (1920) pg. 436; XXXI (1935) pg. 13; XXXVII (1941) pg. 449.
246	Prospect	lode gold	North Bloomfield	18	10	17	----------
247	Bull Run	lode gold	North Bloomfield	18	10	31	Report of the State Mineralogist XXXVII (1941) pg. 446.
248	Carter Group	lode gold	North Bloomfield	17	10	17	Report of the State Mineralogist XVI (1918) pg. 133; XXXVII (1941) pg. 7.
249	Arrowhead	lode gold	Chicago Park	15	09	02	----------
250	Orona	lode gold	Chicago Park	15	09	10	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XXXVII (1941) pg. 458.
251	Prospect	lode gold	Chicago Park	15	09	11	----------

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252	Mountain Maid	lode gold	Chicago Park	15	09	14	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XXXVII (1941) pg. 458.
253	Ben Day	lode gold	Chicago Park	15	09	14	Report of the State Mineralogist XXXVII (1941) plate 3.
254	Steephollow Group	lode gold	Chicago Park	16	10	14	Report of the State Mineralogist XVI (1918) pg. 250; XXXVII (1941) pg. 465.
255	Story Prospect	lode gold	Junction House	17	10	26	Report of the State Mineralogist XXXVII (1941) plate 3.
256	Fruitvale	lode gold	Washington	18	10	10	Report of the State Mineralogist XVI (1918) pg. 169.
257	Sleeping Beauty	lode gold	Washington	18	10	10	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XIII (1896) pg. 264; XXXVII (1941) pg. 463.
258	German Bar	lode gold	Washington	18	10	11	Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist XIII (1896) pg. 244; XVI (1918) pg. 256; XXXVII (1941) pg. 451.

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259	Independent	lode gold	Washington	18	11	07	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XIII (1896) pg. 248; XVI (1918) pg. 192; XXXVII (1941) pg. 385,464.
260	Metropolitan	lode gold	Washington	18	10	15	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XVI (1918) pg. 197; XXXVII (1941) pg. 457.
261	Crackerjack	lode gold	Washington	18	10	14	Report of the State Mineralogist XXXVII (1941) pg. 448.
262	Buckhorn & Wedge	lode gold	Washington	18	10	13	Report of the State Mineralogist XXXVII (1941) plate 3.
263	Twin Sisters	lode gold	Washington	18	10	13	Report of the State Mineralogist XXXVII (1941) plate 3.
264	Howie	lode gold	Washington	18	10	13	Report of the State Mineralogist XXXVII (1941) plate 3.
265	Sadie D	lode gold	Washington	18	10	14	Report of the State Mineralogist XXXVII (1941) plate 3.
266	Prospect	lode gold	Washington	18	11	19	----------

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267	Dillon	lode gold	Washington	18	11	31	Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist XIII (1896) pg. 241; XXXVII (1941) pg. 449.
268	St. Patrick	lode gold	Washington	17	10	01	Report of the State Mineralogist XXXVII (1941) pg. 465.
269	Red Point	lode gold	Washington	17	10	12	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XIII (1896) pg. 262; XVI (1918) pg. 240; XXXVII (1941) pg. 462.
270	Krumbecker	lode gold	Washington	17	11	07	Report of the State Mineralogist XXXVII (1941) plate 3.
271	Red Ledge	lode gold	Washington	17	10	13	Bulletin 50 (1908) pg. 200; Report of the State Mineralogist XVI (1918) pg. 89,239,248; XVII (1920) pg. 438; XXVI (1930) pg. 95; XXXVII (1941) pg. 462.
272	Giant King	lode gold	Washington	17	10	13	Report of the State Mineralogist XIII (1896) pg. 245; XVI (1918) pg. 173; XXXVII (1941) pg. 399,451.

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273	Unknown	lode gold	Holbrook Flat	18	11	08	----------
274	Keller	lode gold	Holbrook Flat	18	11	08	Report of the State Mineralogist XVI (1918) pg. 193; XXXVII (1941) pg. 455.
275	Culbertson	lode gold	Holbrook Flat	18	11	08	Register of Mines (Nevada) pg. 4,10; Report of the State Mineralogist XII (1894) pg. 188; XIII (1896) pg. 240; XVI (1918) pg. 149; XXXVII (1941) pg. 449.
276	National	lode gold	Holbrook Flat	18	11	17	Report of the State Mineralogist XII (1894) pg. 194; XIII (1896) pg. 255; XVI (1918) pg. 149,203.
277	Republic (North)	lode gold	Holbrook Flat	18	11	17	Report of the State Mineralogist XVI (1918) pg. 240; XX (1924) pg. 11; XXXVII (1941) pg. 462.
278	Republic (South)	lode gold	Holbrook Flat	18	11	17	See Republic (North) No. 277.

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279	Ancho Erie	lode gold	Holbrook Flat	18	11	21	Report of the State Mineralogist XVI (1918) pg. 116; XX (1924) pg. 9; XXVI (1930) pg. 101; XXXI (1935) pg. 11; XXXVII (1941) pg. 383,444.
280	Gaston	lode gold	Graniteville	18	11	28	Report of the State Mineralogist XVI (1918) pg. 170; XXVI (1930) pg. 110,113; XXXVII (1941) pg. 399.
281	I.X.L.	lode gold	Holbrook Flat	18	11	29	Report of the State Mineralogist XVI (1918) pg. 101,192.
282	Washington	lode gold	Holbrook Flat	17	11	09	Register of Mines (Nevada) pg. 8,11; Report of the State Mineralogist VIII (1888) pg. 440,441; X (1890) pg. 391; XII (1894) pg. 202; XIII (1896) pg. 266; XVI (1918) pg. 256; XXXVII (1941) pg. 467.
283	Cooley	lode gold	Holbrook Flat	17	11	09	Report of the State Mineralogist XVI (1918) pg. 226,249.
284	Unknown	lode gold	Holbrook Flat	17	11	10	----------

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285	Red Cross	lode gold	Holbrook Flat	17	11	15	Report of the State Mineralogist XXXVII (1941) pg. 462.
286	Unknown	lode gold	Holbrook Flat	17	11	15	----------
287	Celia	lode gold	Holbrook Flat	17	11	16	Report of the State Mineralogist XXXVII (1941) pg. 447.
288	Zeibright	lode gold	Holbrook Flat	17	11	34	Report of the State Mineralogist XVI (1918) pg. 260; XXXVII (1941) pg. 380,431,468.
289	Hotwater	lode gold	Graniteville	18	11	09	Report of the State Mineralogist XXXVII (1941) pg. 403.
290	North Wisconsin	lode gold	Graniteville	18	11	10	See Wisconsin No. 291.
291	Wisconsin	lode gold	Graniteville	18	11	15	Report of the State Mineralogist XIII (1896) pg. 267; XXXVII (1941) pg. 467.
292	Sportswood	lode gold	Graniteville	18	11	16	Report of the State Mineralogist XXXVII (1941) plate 3.
293	Rocky Glen	lode gold	Graniteville	18	11	16	Report of the State Mineralogist VIII (1888) pg. 450,451; XI (1892) pg. 310; XII (1894) pg. 200; XVI (1918) pg. 242; XXXVII (1941) pg. 463.

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294	Poorman	lode gold	Graniteville	18	11	16	Report of the State MIneralogist XXXVII (1941) plate 3.
295	Iowa	lode gold	Graniteville	18	11	15	Report of the State Mineralogist XXXVII (1941) pg. 386,455.
296	Birchville	lode gold	Graniteville	18	11	14	Register of Mines (Nevada) pg. 10; Report of the State Mineralogist XVI (1918) pg. 121; XXXVII (1941) pg. 386,445.
297	Commercial	lode gold	Graniteville	18	11	22	Report of the State Mineralogist XXXVII (1941) plate 3.
298	Barron	lode gold	Graniteville	18	11	23	Report of the State Mineralogist XXXVII (1941) pg. 445.
299	Azalea	lode gold	Graniteville	18	11	22	Report of the State Mineralogist XXXVII (1941) plate 3.
300	Jim	lode gold	Graniteville	18	11	22	Report of the State Mineralogist XXXVII (1941) pg. 408,447.
301	Celina Flat	lode gold	Graniteville	18	11	22	Report of the State Mineralogist XXXVII (1941) pg. 447.
302	Crown Point Extension	lode gold	Graniteville	18	11	22	See Crown Point No. 303.

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303	Crown Point	lode gold	Graniteville	18	11	22	Report of the State Mineralogist VII (1887) pg. 429,693; XIII (1896) pg. 239; XVI (1918) pg. 149; XXXVII (1941) pg. 390,448.
304	Baltic	lode gold	Graniteville	18	11	34	Register of Mines (Nevada) pg. 9,10; Report of the State Mineralogist VIII (1888) pg. 451; XII (1894) pg. 185; XIII (1896) pg. 235; XVI (1918) pg. 119; XXXVII (1941) pg. 444.
305	Ethel	lode gold	Graniteville	18	11	35	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XII (1894) pg. 189; XIII (1896) pg. 242; XVI (1918) pg. 166; XXXVII (1941) pg. 397.
306	Starr	lode gold	Graniteville	18	11	35	Report of the State Mineralogist XVI (1918) pg. 249; XXXVII (1941) pg. 465.
307	Prospect	lode gold	Graniteville	18	11	36	----------
308	Anderson	lode gold	Graniteville	18	11	34	Report of the State Mineralogist XXXVII (1941) plate 3.

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309	Rainbow	lode gold	Graniteville	18	11	34	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XII (1894) pg. 199; XIII (1896) pg. 261; XXXVII (1941) pg. 462.
310	Golden Gate	lode gold	Graniteville	18	11	35	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XVI (1918) pg. 116,180; XXXI (1935) pg. 16; XXXVII (1941) pg. 401,452.
311	Artic	lode gold	Graniteville	17	11	02	Report of the State Mineralogist XXXVII (1941) plate 3.
312	Mountain View	lode gold	Graniteville	17	11	02	Register of Mines (Nevada) pg. 6,10; Report of the State Mineralogist XIII (1896) pg. 255; XXXVII (1941) pg. 458.
313	Prospect	lode gold	Graniteville	17	11	02	----------
314	Lindsay	lode gold	Graniteville	17	11	02	Register of Mines (Nevada) pg. 6; Report of the State Mineralogist XIII (1896) pg. 250; XXXVII (1941) pg. 456.
315	Gray Eagle	lode gold	Graniteville	17	11	02	Report of the State Mineralogist XXXVII (1941) pg. 447.

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316	El Garcia	lode gold	Graniteville	17	11	11	Report of the State Mineralogist XXXVII (1941) plate 3.
317	Yuba	lode gold	Graniteville	17	11	11	Register of Mines (Nevada) pg. 8,11; Report of the State Mineralogist VIII (1888) pg. 435.
318	German	lode gold	Graniteville	17	11	12	Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist XIII (1896) pg. 244; XVI (1918) pg. 256; XXXVII (1941) pg. 451.
319	Mayflower	lode gold	Graniteville	17	11	11	Register of Mines (Nevada) pg. 6,10; Report of the State Mineralogist VIII (1888) pg. 453; XI (1892) pg. 295; XII (1894) pg. 192; XIII (1896) pg. 252; XVI (1918) pg. 196; XX (1924) pg. 10; XXXVII (1941) pg. 457.
320	Blue Bell	lode gold	Graniteville	17	11	12	Register of Mines (Nevada) pg. 10; Report of the State Mineralogist VIII (1888) pg. 437; XVI (1918) pg. 123; XXXVII (1941) pg. 445.

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321	Eagle Bird	lode gold	Graniteville	17	11	12	Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist VI (1886) pg. 51; VIII (1888) pg. 440; X (1890) pg. 389; XVI (1918) pg. 141,152; XVIII (1922) pg. 738; XX (1924) pg. 10; XXVI (1930) pg. 104; XXXI (1935) pg. 13; XXXVII (1941) pg. 391.
322	Goldbug	lode gold	Graniteville	17	11	11	Report of the State Mineralogist XXXVII (1941) plate 3.
323	Last Chance	lode gold	Graniteville	17	11	14	Report of the State Mineralogist XIII (1896) pg. 250; XVI (1918) pg. 86,193.
324	Prospect	lode gold	Bowman-Meadow Lake	18	12	05	----------
325	Yellow Metal	lode gold	Bowman-Meadow Lake	18	12	09	Report of the State Mineralogist XVI (1918) pg. 258; XXXVII (1941) pg. 468.
326	English Mountain	lode gold	Bowman-Meadow Lake	18	13	06	Report of the State Mineralogist XIII (1896) pg. 242; XVI (1918) pg. 85,164; XXXVII (1941) pg. 450.

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327	Prospect	lode gold	Bowman-Meadow Lake	18	13	31	----------
328	Excelsior (Meadow Lake) (Oro Grande Group)	lode gold	Bowman-Meadow Lake	18	13	27	Bulletin 50 (1908) pg. 199; Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist VIII (1888) pg. 454,693; XIII (1896) pg. 243; XVI (1918) pg. 168; XX (1924) pg. 357; Bowman, 1983.
329	Old Man Mountain	lode gold	Bowman-Meadow Lake	17	13	04	Report of the State Mineralogist XXXVII (1941) plate 3.
330	Carlisle	lode gold	Bowman-Meadow Lake	17	13	09	Bulletin 50 (1908) pg. 202; Report of the State Mineralogist XXXVII (1941) pg. 447.
331	Red Mountain	lode gold	Bowman-Meadow Lake	17	13	16	Bulletin 50 (1908) pg. 200; Report of the State Mineralogist XXXVII (1941) pg. 462.
332	Prospect	lode gold	Bowman-Meadow Lake	17	13	17	Bowman (1983) plates.
333	Prospect	lode gold	Bowman-Meadow Lake	17	13	20	Bowman (1983) plates.
334	Prospect	molybdenum	Bowman-Meadow Lake	18	13	07	Southern Pacific Co. (1964) pg. 61.

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335	Mooney Flat	placer gold	West County	16	06	26	Report of the State Mineralogist XI (1892) pg. 316; Lindgren (1911) pg. 121-131; Whitney (1880) pg. 381.
336	North San Juan	placer gold	Northwest County	17	08	05	Register of Mines (Nevada) pg. 7,11; Report of the State Mineralogist XVI (1918) pg. 51,53; Lindgren (1911) pg. 121-131; Whitney (1880) pg. 385-390.
337	Sebastopol	placer gold	Northwest County	17	08	06	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XIII (1896) pg. 263; XXXVII (1941) pg. 463; Whitney (1880) pg. 386,460.
338	Sweetland	placer gold	Northwest County	17	07	13	Whitney (1880) pg. 204,386,460.
339	Birchville	placer gold	Northwest County	17	07	13	Register of Mines (Nevada) pg. 10; Report of the State Mineralogist XVI (1918) pg. 121; XXXVII (1941) pg. 386,445; Whitney (1880) pg. 389.
340	French Corral	placer gold	Northwest County	17	07	26	Report of the State Mineralogist XVI (1918) pg. 7,10,11,101; Whitney (1880) pg. 200,364,383-390.

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
341	Montezuma Hill	placer gold	Northwest County	17	08	22	Whitney (1880) pg. 391.
342	Rough and Ready	placer gold	West County	16	08	19	Report of the State Mineralogist XVI (1918) pg. 54.
343	Hope	placer gold	Grass Valley	16	08	21	Lindgren (1896) plates.
344	Alta Nos. 1&2	placer gold	Grass Valley	16	08	22	Report of the State Mineralogist XXXVII (1941) pg. 444; Whitney (1880) pg. 182.
345	Cement Hill (West)	placer gold	Nevada City	17	08	35	Report of the State Mineralogist XIII (1896) pg. 544; Lindgren (1911) pg. 127; Lindgren (1896) plates; Whitney (1880) pg. 184.
346	Empire Drift	placer gold	Nevada City	16	08	02	Whitney (1880) pg. 190.
347	Howe	placer gold	Nevada City	16	09	06	Lindgren (1896) plates.
348	Nevins Drift	placer gold	Nevada City	17	09	31	Lindgren (1896) plates.
349	Nebraska Drift	placer gold	Nevada City	16	09	06	Report of the State Mineralogist XI (1892) pg. 297; XII (1894) pg. 196; Lindgren (1896) plates.

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350	Manzanita	placer gold	Nevada City	16	09	06	Register of Mines (Nevada) pg. 9; Report of the State Mineralogist II (1882) pg. 170; VIII (1888) pg. 459; XI (1892) pg. 296,302,519; XII (1894) pg. 14,191; XIII (1896) pg. 16,251; XVI (1918) pg. 39,98; Whitney (1880) pg. 184,186,187-189.
351	Grovers Drift	placer gold	Nevada City	16	08	12	Report of the State Mineralogist XIII (1896) pg. 251; XXXVII (1941) pg. 453; Lindgren (1896) plates.
352	Cement Hill (East)	placer gold	Nevada City	16	18	12	Lindgren (1911) pg. 127; Lindgren (1896) plates; Whitney (1880) pg. 184.
353	West Harmony Drift	placer gold	Nevada City	16	09	05	Lindgren (1911) pg. 131; Lindgren (1896) plates.
354	East Harmony Drift	placer gold	Nevada City	16	09	05	Lindgren (1911) pg. 131; Lindgren (1896) plates.

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355	Harmony Drift	placer gold	Nevada City	17	09	32	Register of Mines (Nevada) pg. 9; Report of the State Mineralogist XI (1892) pg. 298; XII (1894) pg. 190; XIII (1896) pg. 247; XVI (1918) pg. 96; XXXI (1935) pg. 15; Lindgren (1911) pg. 131; Lindgren (1896) plates.
356	Badger Hill	placer gold	San Juan Ridge	18	08	36	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XII (1894) pg. 185; XIII (1896) pg. 235,242; Lindgren (1911) pg. 139; Whitney (1880) pg. 394; Jarman (1927) pg. 103-110.
357	Cherokee	placer gold	San Juan Ridge	17	08	01	Report of the State Mineralogist XVI (1918) pg. 93; Whitney (1880) pg. 395; Jarman (1927) pg. 103-110.
358	North Columbia	placer gold	San Juan Ridge	17	09	05	Report of the State Mineralogist XVI (1918) pg. 48; Whitney (1880) pg. 391-398; Lingren (1911) pg. 139; Jarman (1927) pg. 103-110.
359	Val-Metal	placer gold	San Juan Ridge	17	09	09	See Kennebec Hill No. 360.

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360	Kennebec Hill	placer gold	San Juan Ridge	17	09	09	Report of the State Mineralogist XXVI (1930) pg. 118; XXXVII (1941) pg. 455.
361	Grizzly Hill	placer gold	San Juan Ridge	17	09	16	Report of the State Mineralogist XI (1892) pg. 307; XVI (1918) pg. 85; XXXVII (1941) pg. 453; Whitney (1880) pg. 392-395; Jarman (1927) pg. 103-110.
362	Blue Tent	placer gold	Washington Ridge	17	09	21	Bulletin 85 (1919) pg. 26; Report of the State Mineralogist II (1882) pg. 170; XVI (1918) pg. 93; Lindgren (1911) pg. 143; Whitney (1880) pg. 412-414; Jarman (1927) pg. 110.
363	Sailor Flat (Near Blue Tent)	placer gold	Washington Ridge	17	09	22	Report of the State Mineralogist XXIII (1927) pg. 110; Whitney (1880) pg. 412; Jarman (1927) pg. 110.

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364	Malakoff	placer gold	San Juan Ridge	17 17	09 10	01 36	Register of Mines (Nevada) pg. 11; Report of the State Mineralogist XVI (1918) pg. 45; XVIII (1922) pg. 738; Whitney (1880) pg. 203,392,395-397; Jarman (1927) pg. 103-110.
365	Naylor	placer gold	San Juan Ridge	17	09	01	----------
366	Derbec Drift	placer gold	San Juan Ridge	18	10	29	Bulletin 92 (1923) pg. 57; Report of the State Mineralogist VIII (1888) pg. 456; XI (1892) pg. 267,311; XII (1894) pg. 188; XIII (1896) pg. 241; XVI (1918) pg. 45,94; Lindgren (1911) pg. 139.
367	Scotts Flat	placer gold	Scotts Flat Res.	16	10	06	Bulletin 92 (1923) pg. 128; Report of the State Mineralogist XVI (1918) pg. 63; Lindgren (1911) pg. 143; Whitney (1880) pg. 171-181,423-425; Jarman (1927) pg. 100.
368	Sailor Flat (Near Quaker Hill)	placer gold	Scotts Flat Res.	16	10	07	Report of the State Mineralogist XXIII (1927) pg. 110; Lindgren (1911) pg. 143; Whitney (1880) pg. 171-181,423-425.

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369	Quaker Hill	placer gold	Scotts Flat Res.	16	10	17	Report of the State Mineralogist XIII (1896) pg. 17; XVI (1918) pg. 63; XXVI (1930) pg. 135; Lindgren (1911) pg. 143; Whitney (1880) pg. 171-181,423-425; Jarman (1927) pg. 100.
370	Sargent Jacob Drift	placer gold	Scotts Flat Res.	1 6 16	09 10	13 07	Report of the State Mineralogist XI (1892) pg. 318; Lindgren (1896) plates.
371	Buckeye Flat	placer gold	Scotts Flat Res.	16	10	19	Report of the State Mineralogist XVI (1918) pg. 128; Whitney (1880) pg. 420; Jarman (1927) pg. 100.
372	Hunts Hill	placer gold	Scotts Flat Res.	16	09	24	Bulletin 92 (1923) pg. 133; Report of the State Mineralogist XVI (1918) pg. 63; XXIII (1927) pg. 100,101; Whitney (1880) pg. 417,419; Jarman (1927) pg. 100-101.
373	Poore Mine	placer gold	Scotts Flat Res.	16	09	24	See Hunts Hill No. 372.

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374	Red Dog	placer gold	Chalk Bluff Ridge	16	10	30	Report of the State Mineralogist XVI (1918) pg. 63; Lindgren (1911) pg. 144; Whitney (1880) pg. 164,419; Jarman (1927) pg. 99.
375	Chalk Bluff	placer gold	Chalk Bluff Ridge	16	10	30	Report of the State Mineralogist XXVIII (1932) pg. 300; Whitney (1880) pg. 164; Jarman (1927) pg. 99.
376	You Bet	placer gold	Chalk Bluff Ridge	16	10	31, 32	Report of the State Mineralogist XI (1892) pg. 317; XVI (1918) pg. 63,66,107; XXVI (1930) pg. 135; XXXI (1935) pg. 10; Lindgren (1911) pg. 144; Whitney (1880) pg. 164-165,419,422; Jarman (1927) pg. 99.
377	Wallupa	placer gold	Chalk Bluff Ridge	15	10	06	Whitney (1880) pg. 155,164,166,422; Jarman (1927) pg. 99.
378	Little York	placer gold	Dutch Flat	15	10	05	Bulletin 92 (1923) pg. 128; Report of the State Mineralogist XVI (1918) pg. 63; Lindgren (1911) pg. 144; Whitney (1880) pg. 156,159,422; Jarman (1927) pg. 98.

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379	Woolsey Flat	placer gold	San Juan Ridge	18	10	21	Lindgren (1911) pg. 141; Whitney (1880) pg. 201-202,401.
380	Moores Flat	placer gold	San Juan Ridge	18	10	16	Report of the State Mineralogist XVI (1918) pg. 45; Lindgren (1911) pg. 141; Whitney (1880) pg. 200,403.
381	Orleans Flat	placer gold	San Juan Ridge	18	10	15	Register of Mines (Nevada) pg. 10; Report of the State Mineralogist VIII (1888) pg. 432; XIII (1896) pg. 258; XVI (1918) pg. 226; XXXVII (1941) pg. 461; Lingren (1911) pg. 141; Whitney (1880) pg. 200,403.
382	Snow Point	placer gold	San Juan Ridge	18	10	14	Bulletin 92 (1923) pg. 132; Report of the State Mineralogist XVI (1918) pg. 45; Lindgren (1911) pg. 141; Whitney (1880) pg. 200,401-403,406.
383	Alpha	placer gold	Graniteville	18	11	09	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XVI (1918) pg. 116; XXXVII (1941) pg. 444.

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384	Eureka	placer gold	Graniteville	18	11	09	Report of the State Mineralogist XVI (1918) pg. 85; XXVI (1930) pg. 135; Whitney (1880) pg. 406-408.
385	Relief Hill	placer gold	San Juan Ridge	17	10	09	Bulletin 92 (1923) pg. 127; Report of the State Mineralogist XVI (1918) pg. 45; XXIII (1927) pg. 111; XXVIII (1932) pg. 298; Whitney (1880) pg. 201,404; Jarman (1927) pg. 111.
386	Cotton Hill	placer gold	Washington	17	10	14	----------
387	Jefferson Hill	placer gold	Washington	17	10	14	Report of the State Mineralogist XXXVII (1941) pg. 455.
388	Alpha	placer gold	Washington	17	11	18	Register of Mines (Nevada) pg. 4; Report of the State Mineralogist XVI (1918) pg. 59,116; XXXVII (1941) pg. 444; Lindgren (1911) pg. 147; Whitney (1880) pg. 408-410.

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389	Omega	placer gold	Washington	17	11	17	Report of the State Mineralogist XIII (1896) pg. 17,258; XVI (1918) pg. 105; XXVI (1930) pg. 133; XXXVII (1941) pg. 433; Lindgren (1911) pg. 147; Whitney (1880) pg. 408-410; Jarman (1927) pg. 112.
390	Diamond Creek	placer gold	Washington	17	11	15	Register of Mines (Nevada) pg. 5; Report of the State Mineralogist XVI (1918) pg. 151; XXXVII (1941) pg. 449; Whitney (1880) pg. 411.
391	Excelsior	placer gold	Dutch Flat	16	11	05	Register of Mines (Nevada) pg. 5,10; Report of the State Mineralogist VIII (1888) pg. 454,693; XIII (1896) pg. 243; XVI (1918) pg. 168; XX (1924) pg. 357; Whitney (1880) pg. 176-177.
392	Remington Hill	placer gold	Dutch Flat	16	11	06	Bulletin 92 (1923) pg. 134; Report of the State Mineralogist XVI (1918) pg. 30; Lindgren (1911) pg. 147; Whitney (1880) pg. 174-177.
393	Melburn Hill	placer gold	Dutch Flat	1 6	10	01	Whitney (1880) pg. 174-177.

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394	Rose Mountain	placer gold	Dutch Flat	16	10	12	Register of Mines (Nevada) pg. 7,11; Report of the State Mineralogist XIII (1896) pg. 262; XVI (1918) pg. 243; XXXVII (1941) pg. 463.
395	Lowell Hill	placer gold	Dutch Flat	16	10	12	Bulletin 92 (1923) pg. 134; Report of the State Mineralogist XVI (1918) pg. 30; Lindgren (1911) pg. 146; Whitney (1880) pg. 174-177.
396	Swamp Angel Drift	placer gold	Dutch Flat	16	10	12	Jarman (1927) pg. 95.
397	Mammoth Drift	placer gold	Dutch Flat	16	11	08	Report of the State Mineralogist XVI (1918) pg. 195; XXXVII (1941) pg. 457.
398	Oro Drift	placer gold	Dutch Flat	16	10	13, 14	Register of Mines (Nevada) pg. 7; Report of the State Mineralogist XIII (1896) pg. 246; XXXVII (1941) pg. 461.

APPENDIX A - MINES AND PROSPECTS LISTING AND SELECTED REFERENCES

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
399	Liberty Hill	placer gold	Dutch Flat	16	10	23	Register of Mines (Nevada) pg. 6,9; Report of the State Mineralogist XVI (1918) pg. 102; XVII (1920) pg. 440; XX (1924) pg. 12; XXIII (1927) pg. 95; XXXVII (1941) pg. 456; Whitney (1880) pg. 156-157; Jarman (1927) pg. 95.
400	Christmas Hill	placer gold	Dutch Flat	15	10	05	Lindgren (1911) pg. 146; Whitney (1880) pg. 143,155; Jarman (1927) pg. 98.
401	Prospect	placer gold	Bowman lake	18	12	32	----------
402	Snowflower	placer gold	Bowman Lake	18	12	32	----------
403	Sherman Ranch	chromite	Nevada City	16	08	11	Rynearson (1953) pg. 241.
404	Waite	chromite	Nevada City	16	08	11	Rynearson (1953) pg. 241.
405-409	Not Used	----------	----------	--	--	--	----------
410	Bear's Elbow	Sand and Gravel	Colfax	15	09	32	California Department of Transportation File No. 4015; Division of Mines and Geology, MINEFILE database.

APPENDIX A - MINES AND PROSPECTS LISTING AND SELECTED REFERENCES

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
411	Prospect	Sand and Gravel	Colfax	15	09	33	California Department of Transportation File No. 4020.
412	Old Moore Pit	Sand and Gravel	Rough and Ready	16	07	33	California Department of Transportation File No. 4011; Division of Mines and Geology, Mineral Property Report file.
413	Borrow Pit	Sand and Gravel	Rough and Ready	16	07	26	California Department of Transportation File No. 4002.
414	Prospect	Sand and Gravel	Rough and Ready	16	07	17	California Department of Transportation File 4009.
415	Prospect	Sand and Gravel	Chicago Park	16	09	25	California Department of Transportation File No. 4006.
416	Prospect	Sand and Gravel	Chicago Park	16	10	19	California Department of Transportation File No. 4043; United States Forest Service Index No. 27.
417	Prospect	Sand and Gravel	Nevada City	16	08	14	California Department of Transportation File No. 4010, 4042.
418	Prospect	Sand and Gravel	Nevada City	16	08	15	California Department of Transportation File No. 4013.
419	Prospect	Sand and Gravel	Nevada City	16	08	14	California Department of Transportation File No. 4019.

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
420	Prospect	Sand and Gravel	Nevada City	16	08	15	California Department of Transportation File No. 4034.
421	Prospect	Sand and Gravel	Nevada City	17	08	20	California Department of Transportation File No. 4035.
422	Prospect	Sand and Gravel	Nevada City	17	08	15	California Department of Transportation File No. 4033.
423	Prospect	Sand and Gravel	Nevada City	17	08	11	California Department of Transportation File No. 4023.
424	Prospect	Sand and Gravel	N. Bloomfield	17	09	21	California Department of Transportation File No. 4049.
425	Prospect	Sand and Gravel	Washington	17	11	18	United States Forest Service Index No. 7.
426	Prospect	Sand and Gravel	Washington	17	11	17	United States Forest Service Index No. 14.
427	Prospect	Sand and Gravel	Blue Canyon	17	12	30	California Department of Transportation File No. 4032.
428	Prospect	Sand and Gravel	Blue Canyon	17	12	20	California Department of Transportation File No. 4029.
429	Prospect	Sand and Gravel	Blue Canyon	17	12	20	United States Forest Service Index No. 41.

APPENDIX A - MINES AND PROSPECTS LISTING AND SELECTED REFERENCES

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
430	Prospect	Sand and Gravel	Graniteville	18	12	31	United States Forest Service Index No. 29.
431	Prospect	Sand and Gravel	Cisco Grove	17	13	20	United States Forest Service Index No. 10.
432	Prospect	Sand and Gravel	Soda Springs	17	13	15	California Department of Transportation File No. 4040.
433	Prospect	Sand and Gravel	Soda Springs	17	13	15	United States Forest Service Index No. 36.
434	Prospect	Sand and Gravel	Soda Springs	17	13	14	California Department of Transportation File No. 4044.
435	Old Clements Pit	Sand and Gravel	Truckee	17	16	17	United States Forest Service Index No. 3.
436	Old Clements Pit	Sand and Gravel	Truckee	17	16	17	California Department of Transportation File No. 4008.
437	Prospect	Sand and Gravel	Martis Peak	18	17	35	California Department of Transportation File No. 4052.
438	Prosser Borrow Pits	Sand and Gravel	Prosser Reservoir	18	16	25	California Department of Transportation File No. 4045.
439	Prosser Borrow Pits	Sand and Gravel	Prosser Reservoir	18	16	24	United States Forest Service Index No. 9a.

APPENDIX A - MINES AND PROSPECTS LISTING AND SELECTED REFERENCES

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
440	Prospect	Sand and Gravel	Martis Peak	17	17	32	California Department of Transportation File No. 4016.
441	Prospect	Sand and Gravel	Martis Peak	17	17	36	California Department of Transportation File No. 4047.
442	Prospect	Sand and Gravel	Martis Peak	17	17	34	California Department of Transportation File No. 4021.
443	Prospect	Sand and Gravel	Martis Peak	17	18	06	California Department of Transportation File No. 4027.
444	Old Hirschdale Pit	Sand and Gravel	Martis Peak	17	17	34	United States Forest Service Index No. 11; Division of Mines and Geology, MINEFILE database.
445	Prospect	Sand and Gravel	Martis Peak	17	17	32	California Department of Transportation File No. 4041.
446	Idaho-Maryland	Crushed Stone	Grass Valley	16	08	26	Division of Mines and Geology, MINEFILE database.
447	Borrow Pit	Sand and Gravel	Hobart Mills	18	16	15	----------
448	Martis Valley Pit	Sand and Gravel	Martis Peak	17	17	08	Division of Mines and Geology, MINEFILE database.

APPENDIX A - MINES AND PROSPECTS LISTING AND SELECTED REFERENCES

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
449	Lake Combie Pit	Sand and Gravel	Lake Combie	14	08	25	California Department of Transportation File No 4007; Division of Mines and Geology, MINEFILE database.
450	Not Used	----------	----------	--	--	--	----------
451	Greenhorn Creek	Sand and Gravel	Chicago Park	16	09	35	Division of Mines and Geology, MINEFILE database.
452	Placer Silica Pit	Sand and Gravel	Chicago Park	15	10	06	Division of Mines and Geology, MINEFILE database.
453	Prospect	Sand and Gravel	N. Bloomfield	16	10	05	United States Forest Service Index No. 9.
454	Prospect	Sand and Gravel	Nevada City	16	08	14	United States Forest Service Index No. 12.
455	Not Used						
456	N.C. Gravel	Sand and Gravel	N. Bloomfield	17	09	09	Division of Mines and Geology, MINEFILE database.
457	Prospect	Crushed Stone	Rough and Ready	15	07	03	California Department of Transportation File No. 4024.
458	Prospect	Crushed Stone	Washington	17	10	12	United States Forest Service Index No. 70a.

APPENDIX A - MINES AND PROSPECTS LISTING AND SELECTED REFERENCES

Index #	Name	Type	Area	T.	R.	Sec.	Selected References
459	Borrow Pit	Crushed Stone	Washington	17	10	13	United States Forest Service Index No. 8b.
460	Borrow Pit	Crushed Stone	Washington	17	10	13	United States Forest Service Index No. 8a.
461	Prospect	Crushed Stone	Graniteville	19	12	31	United States Forest Service Index No. 46.
462	Prospect	Crushed Stone	Graniteville	19	12	31	United States Forest Service Index No. 40.
463	Prospect	Crushed Stone	Norden	17	15	08	California Department of Transportation File No. 4046.
464	Prospect	Crushed Stone	Norden	17	15	10	California Department of Transportation File No. 4004.
465	Old Sha-Neva pit	Crushed Stone	Truckee	17	16	10	United States Forest Service Index No. 5.
466	Prospect	Crushed Stone	Boca	18	18	07	California Department of Transportation File No. 4037.
467	Sha-Neva Cinder Pit 2	Crushed Stone	Martis Peak	18	17	32	Division of Mines and Geology, MINEFILE database; United States Forest Service Index No. 10.
468	Old West River Pit	Crushed Stone	Boca	18	17	26	Proprietary consultants report.

APPENDIX A

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APPENDIX B

CALIFORNIA MINERAL LAND CLASSIFICATION DIAGRAM NOMENCLATURE

CALIFORNIA MINERAL LAND CLASSIFICATION DIAGRAM NOMENCLATURE

Following are definitions of the nomenclature associated with the California Mineral Land Classification Diagram. These definitions have been adapted from U.S. Bureau of Mines and U.S. Geological Survey (1980) and Bates and Jackson (1987). It is important to refer to these definitions when studying the different resource categories shown on the diagram. Particular attention should be given to the distinction between a mineral deposit and a resource and to how a mineral deposit may relate to resources.

MINERAL DEPOSIT: A mass of naturally occurring mineral material, e.g. metal ores or nonmetallic minerals, usually of economic value, without regard to mode of origin. The mineral material may be of value for its chemical and/or physical characteristics.

MINERAL OCCURRENCE: Any ore or economic mineral in any concentration found in bedrock or as float; especially a valuable mineral in sufficient concentration to suggest further exploration.

ECONOMIC: This term implies that profitable extraction or production under defined investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty.

MINERAL RESOURCE: A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible. The terms <u>resource</u> and <u>mineral resource</u> are synonymous in this report.

RESERVES: That part of the resource base which could be economically extracted or produced at the time of determination. The term <u>reserves</u> need not signify that extraction facilities are in place and operative. In the case of aggregates, the term includes only permitted resources.

IDENTIFIED MINERAL RESOURCES: Resources whose location, grade, quality, and quantity are known or estimated from specific geologic evidence. <u>Identified mineral resources</u> include economic, marginally economic, and subeconomic components. To reflect varying degrees of geologic certainty, these economic divisions can be subdivided into <u>demonstrated</u> and <u>inferred</u>.

DEMONSTRATED: A term for the sum of measured plus indicated.

MEASURED: Quantity is computed from dimensions revealed in outcrops, trenches, workings, or drill holes; grade and/or quality are computed from the results of detailed sampling. The sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of the resource are well established.

INDICATED: Quantity and grade and/or quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, and measurement are further apart or otherwise less adequately spaced. The degree of assurance, although lower than that of measured resources, is high enough to assume continuity between points of observation.

INFERRED: Estimates are based on an assumed continuity beyond measured and/or indicated resources, for which there is geologic evidence. Inferred resources may or may not be supported by samples or measurements.

MARGINAL RESERVES: The part of the demonstrated reserve base that, at the time of determination, borders on being economically producible. Its essential characteristic is economic uncertainty. Included are resources that would be producible, given postulated changes in economic or technologic factors.

MARGINAL RESOURCES: The part of the inferred resource base that, at the time of determination, would be economically producible, given postulated changes in economic or technologic factors.

SUBECONOMIC RESOURCES: The part of identified resources that does not meet the economic criteria of marginal reserves and marginal resources.

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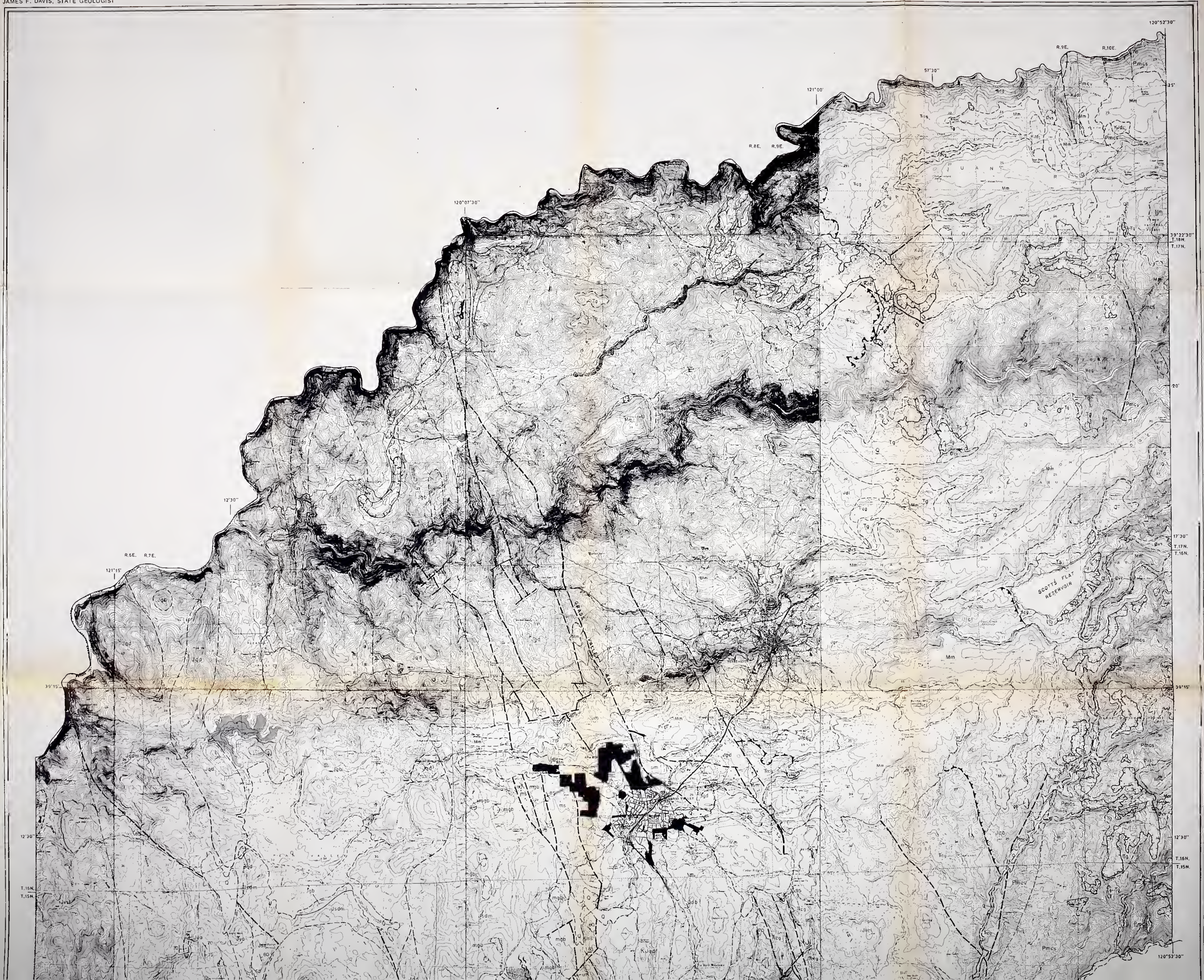

Mosaicked from: Oregon House, Smartville, Camp Far West, French Corral, Challenge, Rough and Ready, Wolf, Camptonville, Nevada City, Grass Valley, Lake Combie, Pike, North Bloomfield, Chicago Park, and Colfax U.S.G.S. 7.5' Topographic Quadrangles.

GEOLOGIC MAP OF WESTERN NEVADA COUNTY, CALIFORNIA

by
Ralph Loyd and John Clinkenbeard

SCALE 1:48000

2 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

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See Plate 1d for Map Explanation

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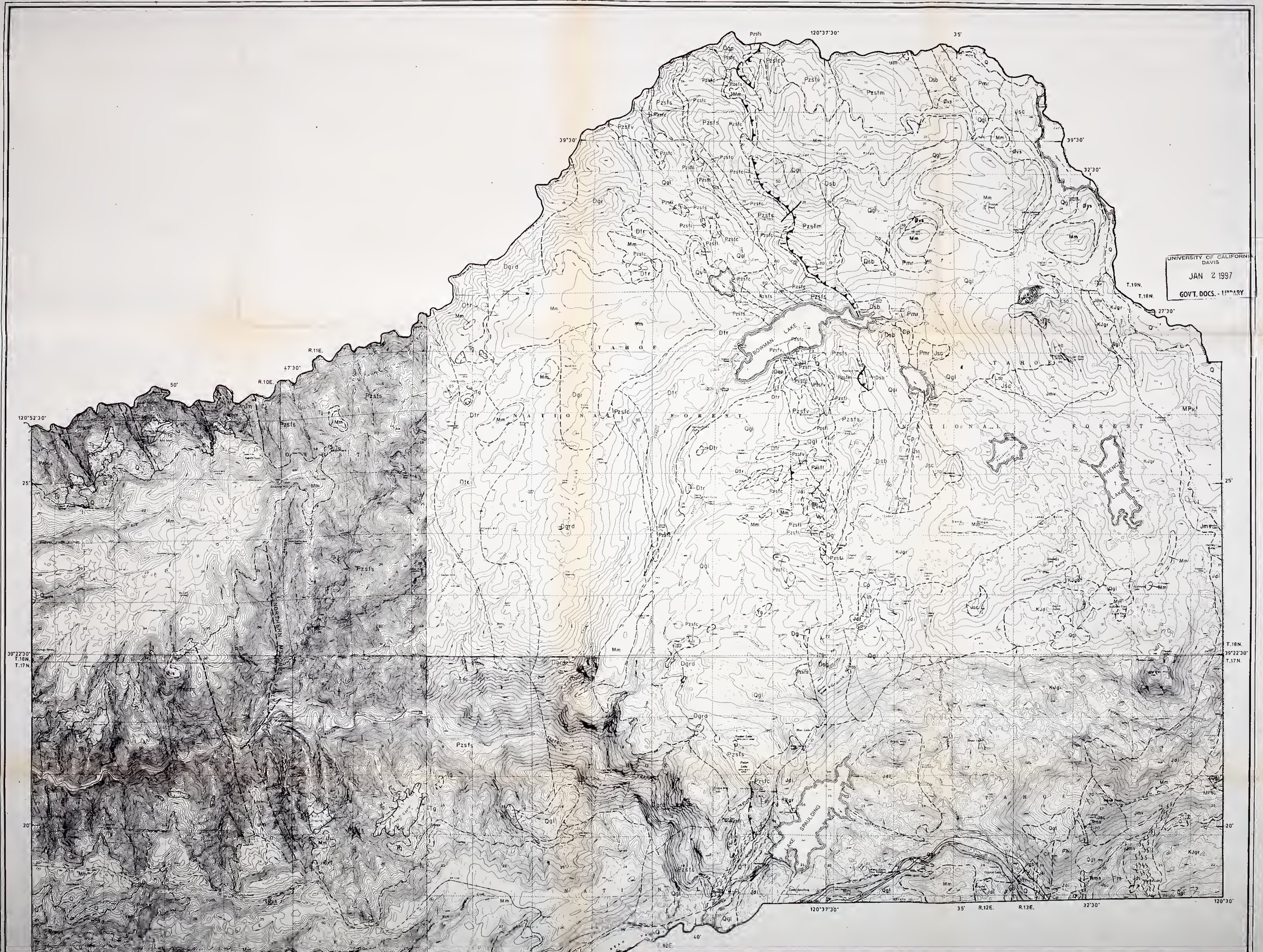

GEOLOGIC MAP OF CENTRAL NEVADA COUNTY, CALIFORNIA

by
Ralph Loyd and John Clinkenbeard

SCALE 1:48000

2 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 1 0 2 KILOMETERS

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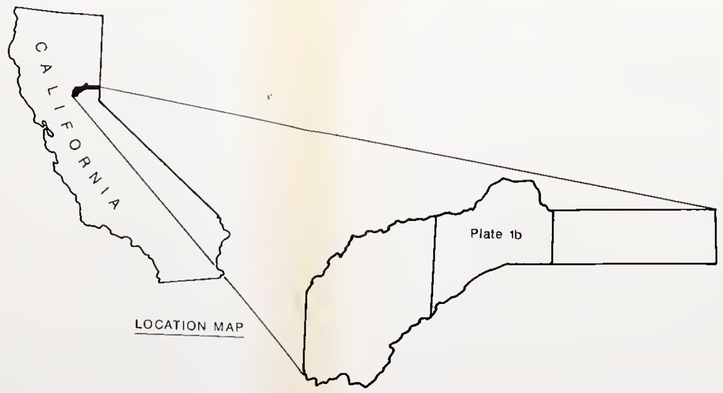
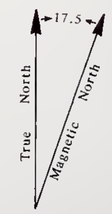
(See Plate 1d for Map Explanation)





Mosaicked from Alleghany, Washington, Dutch Flat, Sierra City, Graniteville, Blue Canyon, Haypress Valley, English Mtn., and Cisco Grove U.S.G.S. 7.5' Topographic Quadrangles.

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Mosaicked from: Soda Springs, Webber Peak, Independence Lake, Norden, Hobart Mills, Truckee, Boca, and Martis Peak U.S.G.S. 7.5' topographic quadrangles.

GEOLOGIC MAP OF EASTERN NEVADA COUNTY

by
Ralph Loyd and John Clinkenbeard

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2 0 2 KILOMETERS

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PLATE 1d

EXPLANATION FOR GEOLOGIC MAPS OF NEVADA COUNTY, CALIFORNIA

By

Ralph C. Loyd and John P. Clinkenbeard

1990

GEOLOGIC EXPLANATION

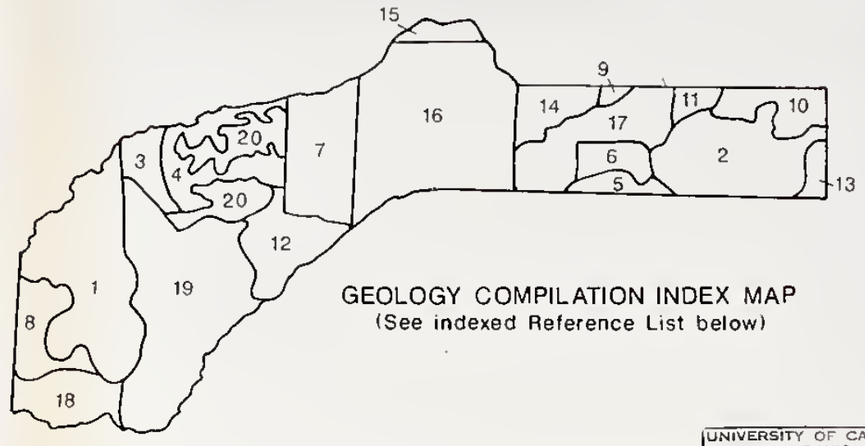
Million Years Ago	ERA	PERIOD	EPOCH
0.01	CENOZOIC	QUATERNARY	HOLOCENE
1.6			PLEISTOCENE
5		TERTIARY	PLIOCENE
24			MIOCENE
36			OLIGOCENE
58		PALEOCENE	EOCENE
65	MESOZOIC	CRETACEOUS	
144		JURASSIC	

TERTIARY SEDIMENTARY AND VOLCANIC ROCKS

t	Placer dredge tailings.
af	Artificial fill (Prosser and Martis Creek dams).
Q	Recent alluvium and colluvium.
Qls	Landslide deposits, lithologically similar to parent materials.
Qos	Older Quaternary fluvial and lacustrine deposits.
Qt	Quaternary terrace deposits.
Qglt	Tahoe and Tioga glacial outwash deposits in the Martis Valley area.
Qgl	Undifferentiated glacial till, moraine, and outwash deposits of varying ages.
Qvb	Quaternary volcanic rocks; basaltic flows, intrusions, and pyroclastic deposits.
Qvc	Quaternary cinder cone, scoria, and tuff deposits.
Pva	Pliocene volcanic rocks; andesitic flows, intrusions, and pyroclastic deposits.
Pvb	Pliocene volcanic rocks; basaltic flows and intrusions.
Pvc	Pliocene cinder cone, scoria, and tuff deposits.
Pia	Pliocene intrusive rocks; intermediate composition.
Ps	Pliocene nonmarine sedimentary deposits; mainly stream and lake deposits including sandstone, conglomerate, diatomite, and rhyolite tuff.
Mn	Mehrten Formation (Miocene-Pliocene); volcanic-derived sediments, andesitic mudflows, volcanic breccias, and minor lava flows equivalent in part to MPv exposed in eastern county region.
MPv	Miocene-Pliocene volcanic rocks; andesitic and basaltic flows, intrusions, and pyroclastic deposits.
MPia	Intrusive rocks; intermediate composition.
Øvr	Oligocene volcanic rocks; rhyolite, welded and non-welded tuff, sandstone, siltstone, claystone, and conglomerate deposits. Traditionally mapped as Valley Springs Formation (Øvs) in western Sierra Nevada foothills.
Øvs	Valley Springs Formation (Oligocene); rhyolite, welded and non-welded tuff, sandstone, siltstone, claystone, and conglomerate deposits. Equivalent to Øvr exposed in eastern county region.
Tg	"Auriferous Gravels" - Ancient river channel deposits dominated by sand, gravel, and cobbles derived from pre-Tertiary basement rock. Mostly Eocene in age, but may include older and younger deposits.

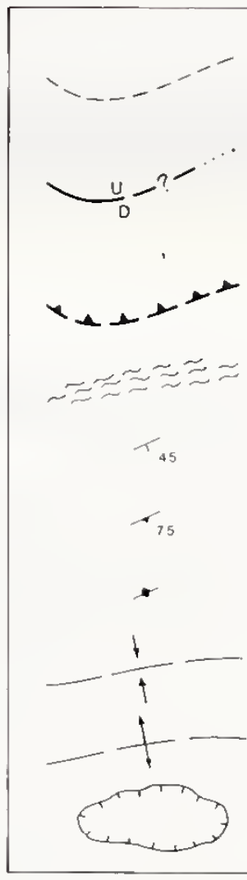
MESOZOIC AND PALEOZOIC METAMORPHIC AND IGNEOUS ROCKS

KJgr	Cretaceous-Jurassic plutonic rocks; granodiorite.
KJqd	Cretaceous-Jurassic plutonic rocks; quartz diorite.
KJdi	Cretaceous-Jurassic plutonic rocks; diorite.
KJgb	Cretaceous-Jurassic plutonic rocks; gabbro.
Jqr	Jurassic plutonic rocks; quartz diorite to granodiorite.
Jdi	Jurassic plutonic rocks; diorite.
Jqd	Jurassic plutonic rocks; quartz diorite and tonalite.
Jdb	Jurassic hypabyssal rocks; diabase.
Jgd	Jurassic plutonic rocks; predominantly gabbro, but locally including diorite and quartz diorite.
Jgb	Jurassic plutonic rocks; gabbro.
Jdm	Jurassic dike rocks; mafic.
Jmgb	Jurassic plutonic rocks; meta-gabbro (exposed in Smartville Complex).
Jsdm	Smartville Complex (Jurassic); undifferentiated mafic flows and diabasic hypabyssal rocks.
Jds	Smartville Complex (Jurassic); mafic sheeted dikes.
Jss	Smartville Complex (Jurassic); Volcanic-derived, fine- to medium-grained clastic sediments.
Jvh	Smartville Complex (Jurassic); hydrothermally altered volcanic rocks. These exposures are marked by pronounced silica-sericite-pyrite alteration associated with polymetallic massive sulfide mineralization.
Jv	Jurassic volcanic rocks; dominated by pyroclastic deposits of intermediate composition. Includes some fine- to medium-grain volcanic-derived sediments.
Jvsu	Smartville Complex (Jurassic); upper volcanic unit composed predominantly of mafic to intermediate volcanic flows, flow breccias, and volcaniclastic sediments.
Jvsl	Smartville Complex (Jurassic); lower volcanic unit composed predominantly of epidote-rich mafic pillow lavas and flows, along with minor chert.
Jlcu	Lake Combie Complex (Jurassic); upper unit dominated by interbedded volcanic-derived sediments along with pyroclastic tuffs and minor volcanic flows.
Jlcm	Lake Combie Complex (Jurassic); middle unit dominated by interbedded pyroclastic tuffs, tuff-breccias, and volcanic flows along with subordinate volcanic derived sediments.
Jlcl	Lake Combie Complex (Jurassic); lower unit dominated by interbedded volcanic flows, flow-breccias, and



GEOLOGY COMPILATION INDEX MAP
(See indexed Reference List below)

SYMBOLS



Geologic contact.

Fault trace, solid where well-located; dashed where approximate; queried where inferred; dotted where concealed. U – Upthrown block; D – downthrown block.

Thrust fault, barbs on upper plate.

Shear zone.

Attitude of bedding.

Attitude of foliation.

Strike of vertical foliation.

Axis of syncline.

Axis of anticline.

Boundary of hydraulic pit.

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3. Bobbitt, J.B., 1982, Petrology, structure, and contact relations of part of the Yuba Rivers pluton, northwestern Sierra Nevada foothills, California: University of California, Davis, M.S. thesis, 160 p., plate 1, scale 1:62,500.

Tertiary geology from: Yeend, W.E., 1974 (see reference 20); and Lindgren, Waldemar, and Turner, H.W., 1895 (see reference 11).

4. Hacker, B.R., 1984, Stratigraphy and structure of the Yuba Rivers area, central belt, northern Sierra Nevada, California: University of California, Davis, M.S. thesis, 125 p., plate 1, scale 1:24,000. Modified by Hodor, Ellen F., 1983, Unpublished geologic mapping for Placer Service Corporation. Tertiary stratigraphy from: Lindgren, Waldemar, 1900 (see reference 12).

Peterson, D.N., 1980, A study of modern sedimentation at Malakoff Diggins State Historic Park, Nevada County, California: University of California, Davis, M.S. thesis, 87 p., plate 1, scale 1:12,000.

5. Harwood, D.S., 1980, Geologic map of the North Fork of the American River Wilderness Study Area and adjacent parts of the Sierra Nevada, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1177-A, scale 1:62,500. Tertiary geology in part of the Dutch Flat 7.5-minute quadrangle from: Yeend, W.E., 1974 (see reference 20).

6. Hudson, F.S., 1951, Mount Lincoln-Castle Peak area Sierra Nevada, California: Bulletin of the Geological Society of America, v. 62, no. 8, p. 931-952, plate 1, scale 1:62,500.

7. Kato, T.T., 1982, Geology of areas adjacent to the Melones fault zone in the vicinity of the Middle and South Forks, Yuba River: Unpublished map and report for the California Department of Conservation, Division of Mines and Geology Data Base Augmentation Program, scale 1:24,000. Additions and modifications from: Southern Pacific Company, 1959, Regional geologic mapping program: Unpublished map of T17N, R10-11E MDB&M, scale 1:24,000; and Yeend, W.E., 1974 (see reference 20).

8. Kilbreath, S.P., Lide, C.S., and Hyde, C.C., 1984, Regional geologic map of the joint venture area of interest, Nevada County, California: Nevcan Exploration Inc., unpublished mapping, plate 2, scale 1:24,000.

Xenophontos, Costas, 1984, Geology, petrology, and geochemistry of part of the Smartville complex, northern Sierra Nevada foothills, California: University of California, Davis, Ph.D. thesis, 446 p., plate 1, scale 1:62,500. Tertiary geology around Smartville from: Lindgren, Waldemar, and Turner, H.W., 1895 (see reference 11).

9. Kimball, R.D., 1967, Geology of the north-central part of the Donner Pass quadrangle, Sierra and Nevada Counties, California: University of California, Davis, M.S. thesis, 70 p., plate 1, scale 1:24,000.

10. Lathan, T.S., Jr., 1985, Stratigraphy, structure, and geochemistry of Plio-Pleistocene volcanic rocks of the western basin and range province, near Truckee, California: University of California, Davis, Ph.D. dissertation, 341 p., plate 1, scale 1:31,000. Additions and modifications from: Southern Pacific Company, 1959, Regional geologic mapping program: Unpublished maps of Sec. 19, T18N, R18E and Sec. 33, T19N, R17E MDB&M, scale 1:24,000. Dog Valley fault from: Hawkins, F.F., LaForge, Roland, and Hansen, R.A., 1986 (see reference 2).

11. Lingren, Waldemar, 1897, Geologic Atlas of the United States, Truckee Folio: U.S. Geological Survey Folio 39, scale 1:125,000. Dog Valley fault from: Hawkins, F.F., LaForge, Roland, and Hansen, R.A., 1986 (see reference 2).

12. Lindgren, Waldemar, 1900, Geologic Atlas of the United States, Colfax Folio: U.S. Geological Survey Folio 66, scale 1:125,000.

Tv — Tuolumne Intrusive Complex (Cretaceous); volcanic rocks; rhyolite, welded and non-welded tuff, sandstone, siltstone, claystone, and conglomerate deposits. Traditionally mapped as Valley Springs Formation (Tvs) in western Sierra Nevada foothills.

Tvs — Valley Springs Formation (Oligocene); rhyolite, welded and non-welded tuff, sandstone, siltstone, claystone, and conglomerate deposits. Equivalent to Tv exposed in eastern county region.

MPv — Miocene-Pliocene volcanic rocks; andesitic and basaltic flows, intrusions, and pyroclastic deposits.

MPia — Intrusive rocks; intermediate composition.

Tvr — Oligocene volcanic rocks; rhyolite, welded and non-welded tuff, sandstone, siltstone, claystone, and conglomerate deposits. Traditionally mapped as Valley Springs Formation (Tvs) in western Sierra Nevada foothills.

Tvs — Valley Springs Formation (Oligocene); rhyolite, welded and non-welded tuff, sandstone, siltstone, claystone, and conglomerate deposits. Equivalent to Tvr exposed in eastern county region.

Tg — "Auriferous Gravels" - Ancient river channel deposits dominated by sand, gravel, and cobbles derived from pre-Tertiary basement rock. Mostly Eocene in age, but may include older and younger deposits.

MESOZOIC AND PALEOZOIC METAMORPHIC AND IGNEOUS ROCKS

KJgr — Cretaceous-Jurassic plutonic rocks; granodiorite.

KJqd — Cretaceous-Jurassic plutonic rocks; quartz diorite.

KJdi — Cretaceous-Jurassic plutonic rocks; diorite.

KJgb — Cretaceous-Jurassic plutonic rocks; gabbro.

Jgr — Jurassic plutonic rocks: quartz diorite to granodiorite.

Jdi — Jurassic plutonic rocks; diorite.

Jqd — Jurassic plutonic rocks; quartz diorite and tonalite.

Jdb — Jurassic hypabyssal rocks; diabase.

Jgd — Jurassic plutonic rocks; predominantly gabbro, but locally including diorite and quartz diorite.

Jgb — Jurassic plutonic rocks; gabbro.

Jdm — Jurassic dike rocks; mafic.

Jmgb — Jurassic plutonic rocks; meta-gabbro (exposed in Smartville Complex).

Jsdm — Smartville Complex (Jurassic): undifferentiated mafic flows and diabasic hypabyssal rocks.

Jds — Smartville Complex (Jurassic): mafic sheeted dikes.

Jss — Smartville Complex (Jurassic): Volcanic-derived, fine- to medium-grained clastic sediments.

Jva — Smartville Complex (Jurassic): hydrothermally altered volcanic rocks. These exposures are marked by pronounced silica-sericite-pyrite alteration associated with polymetallic massive sulfide mineralization.

Jv — Jurassic volcanic rocks; dominated by pyroclastic deposits of intermediate composition. Includes some fine- to medium-grain volcanic-derived sediments.

Jvsu — Smartville Complex (Jurassic); upper volcanic unit composed predominantly of mafic to intermediate volcanic flows, flow breccias, and volcaniclastic sediments.

Jvsl — Smartville Complex (Jurassic); lower volcanic unit composed predominantly of epidote-rich mafic pillow lavas and flows, along with minor chert.

Jlcu — Lake Combie Complex (Jurassic); upper unit dominated by interbedded volcanic-derived sediments along with pyroclastic tuffs and minor volcanic flows.

Jlcm — Lake Combie Complex (Jurassic): middle unit dominated by interbedded pyroclastic tuffs, tuff-breccias, and volcanic flows along with subordinate volcanic derived sediments.

Jlcl — Lake Combie Complex (Jurassic); lower unit dominated by interbedded volcanic flows, flow-breccias, and pyroclastic tuff-breccias.

Jmv — Tuttle Lake Formation (Jurassic); metavolcanic lava flow and breccia deposits of mafic to andesitic composition.

Jsc — Sailor Canyon Formation (Jurassic); tuffaceous sandstone and volcanic conglomerate deposits.

JTrls — Jura-Triassic limestone and calc-silicate rocks.

ms — Tectonic melange; composed predominantly of chaotic assemblage of chert and argillite beds exposed along Wolf Creek and Weimar fault zones. Believed to correlate with rocks of the Triassic(?) Clipper Gap Formation.

Trcg — Clipper Gap Formation (Triassic?); highly disrupted assemblage of interbedded and massive beds of chert and argillite. Locally tectonically intermixed within a slate matrix (sedimentary melange).

gb — Pre-Tertiary plutonic rocks; gabbro.

mgb — Pre-Tertiary meta-gabbro.

un — Pre-Tertiary serpentinized ultramafic rock.

Pmcm — Calaveras Complex melange (Permian-Triassic?); chaotic assemblage of metasedimentary and metavolcanic rocks.

Pmcs — Calaveras Complex metasedimentary rocks (Permian-Triassic?); predominantly phyllite, diamictite, and chert.

Pmcv — Calaveras Complex volcanic rocks (Permian-Triassic?): predominantly andesitic tuff and tuffaceous sediments, but including, flow, breccia, and hypabyssal rocks.

Pmr — Reeve Formation (Permian); includes tuff, siltstone, volcanic breccia, and conglomerate.

Cp — Peale Formation (Carboniferous); rhythmically bedded radiolarian chert, interbedded shale, and chert breccia.

Dsb — Sierra Buttes Formation (Devonian): tuffaceous siltstone and shale, silicic tuff-breccia, andesitic tuff turbidites, and black phosphatic radiolarian chert.

Dg — Grizzly Formation (Devonian); conglomerate and quartzose sandstone exposed along Penner and Culbertson Lakes.

Dgrd — Devonian plutonic rocks of the Bowman Lake batholith; biotite-hornblende granodiorite.

Dgr — Devonian plutonic rocks of the Bowman Lake batholith: biotite granite.

Dtr — Devonian plutonic rocks of the Bowman Lake batholith; trondhjemite.

Pzsfm — Shoo Fly Complex (Early Paleozoic); tectonic melange unit composed of angular blocks of volcanic and arkosic sandstone, chert, volcanic, and carbonate rock in a shaly matrix.

Pzsfs — Shoo Fly Complex (Early Paleozoic); quartzo-feldspathic sandstone and quartzite unit. Also includes subordinate chert, carbonaceous slate, quartz pebble conglomerate, phyllite, and limestone.

Pzsfl — Shoo Fly Complex (Early Paleozoic); carbonate unit. Includes limestone, dolomite, and marble. In part oolitic and pisolitic and locally containing minor amounts of quartz sandstone, chert, argillite, and basalt.

Pzsfv — Shoo Fly Complex (Early Paleozoic); volcanic unit. Composed mainly of mafic flows, locally pillowed.

Pzsfc — Shoo Fly Complex (Early Paleozoic); chert unit. Rhythmically-bedded radiolarian and sponge spicule-bearing chert with minor argillite and calcareous sediments.

Strike of vertical foliation.

Axis of syncline.

Axis of anticline.

Boundary of hydraulic pit.

Bobbitt, J.B., 1982, Petrology, structure, and contact relations of part of the Yuba Rivers pluton, northwestern Sierra Nevada foothills, California: University of California, Davis, M.S. thesis, 160 p., plate 1, scale 1:62,500.

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Harwood, D.S., 1980, Geologic map of the North Fork of the American River Wilderness Study Area and adjacent parts of the Sierra Nevada, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1177-A, scale 1:62,500. Tertiary geology in part of the Dutch Flat 7.5-minute quadrangle from: Yeend, W.E., 1974 (see reference 20).

Hudson, F.S., 1951, Mount Lincoln-Castle Peak area Sierra Nevada, California: Bulletin of the Geological Society of America, v. 62, no. 8, p. 931-952, plate 1, scale 1:62,500.

Kato, T.T., 1982, Geology of areas adjacent to the Melones fault zone in the vicinity of the Middle and South Forks, Yuba River: Unpublished map and report for the California Department of Conservation, Division of Mines and Geology Data Base Augmentation Program, scale 1:24,000. Additions and modifications from: Southern Pacific Company, 1959, Regional geologic mapping program: Unpublished map of T17N, R10-11E MDB&M, scale 1:24,000; and Yeend, W.E., 1974 (see reference 20).

Kilbreath, S.P., Lide, C.S., and Hyde, C.C., 1984, Regional geologic map of the joint venture area of interest, Nevada County, California: Nevcan Exploration Inc., unpublished mapping, plate 2, scale 1:24,000.

Xenophontos, Costas, 1984, Geology, petrology, and geochemistry of part of the Smartville complex, northern Sierra Nevada foothills, California: University of California, Davis, Ph.D. thesis, 446 p., plate 1, scale 1:62,500. Tertiary geology around Smartville from: Lindgren, Waldemar, and Turner, H.W., 1895 (see reference 1).

Kimball, R.D., 1967, Geology of the north-central part of the Donner Pass quadrangle, Sierra and Nevada Counties, California: University of California, Davis, M.S. thesis, 70 p., plate 1, scale 1:24,000.

Latham, T.S., Jr., 1985, Stratigraphy, structure, and geochemistry of Plio-Pleistocene volcanic rocks of the western basin and range province, near Truckee, California: University of California, Davis, Ph.D. dissertation, 341 p., plate 1, scale 1:31,000. Additions and modifications from: Southern Pacific Company, 1959, Regional geologic mapping program: Unpublished maps of Sec. 19, T18N, R18E and Sec. 33, T19N, R17E MDB&M, scale 1:24,000. Dog Valley fault from: Hawkins, F.F., LaForge, Roland, and Hansen, R.A., 1986 (see reference 2).

Lingren, Waldemar, 1897, Geologic Atlas of the United States, Truckee Folio: U.S. Geological Survey Folio 39, scale 1:125,000. Dog Valley fault from: Hawkins, F.F., LaForge, Roland, and Hansen, R.A., 1986 (see reference 2).

Lindgren, Waldemar, 1900, Geologic Atlas of the United States, Colfax Folio: U.S. Geological Survey Folio 66, scale 1:125,000. Modifications to Tertiary geology from: Yeend, W.E., 1974 (see reference 20).

Clark, L.D., 1976, Stratigraphy of the north half of the Western Sierra Nevada metamorphic belt, California: U.S. Geological Survey Professional Paper 923, 26 p., plate 1, scale 1:316,800.

Clark, L.D., and Huber, N.K., 1975, Geologic observations and sections along selected stream traverses, northern Sierra Nevada metamorphic belt, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-690, scale 1:62,500.

Matthews, R.A., 1968, Geology of the north half of the Lake Tahoe basin, California and Nevada, in Burnett, J.L., 1971, Geology of the Lake Tahoe basin: California Geology, v. 24, n. 7, p. 119-127, scale 1:125,000.

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Schweickert, R.A., and Hanson, R.E., (in preparation), Geologic map of the Sierra City 15-minute quadrangle, Sierra and Nevada Counties, California: U.S. Geological Survey, scale 1:62,500.

Schweickert, R.A., Harwood, D.S., Girty, G.H., and Hanson, R.E., (in preparation), Geologic map of the Emigrant Gap 15-minute quadrangle, Nevada and Placer Counties, California: U.S. Geological Survey, scale 1:62,500. Additions and modifications to Tertiary geology along the northeastern edge of the Graniteville 7.5-minute quadrangle from: Yeend, W.E., 1974 (see reference 20). Additions and modifications in the Blue Canyon and English Mtn. 7.5-minute quadrangles from: Southern Pacific Company, 1959, Regional geologic mapping program: Unpublished maps of T17N, R10-11E and T18N, R12-13E MDB&M, scale 1:24,000; and Kato, T.T., 1982 (see reference 7).

Southern Pacific Company, 1959, Regional geologic mapping program: Unpublished maps of T17N, R12-14E; T18N, R14-15E; and T19N, R15E MDB&M, scale 1:24,000.

Springer, R.K., 1981, Geologic report on the Bear River area, northeast of Auburn, California: Unpublished maps and report for the California Department of Conservation, Division of Mines and Geology Data Base Augmentation Program, 26 p., scale 1:24,000.

Xenophontos, Costas, 1984, Geology, petrology, and geochemistry of part of the Smartville complex, northern Sierra Nevada foothills, California: University of California, Davis, Ph.D. thesis, 446 p., plate 1, scale 1:62,500.

Tumlnas, Alvydas, 1983, Structural and stratigraphic relations in the Grass Valley - Colfax area of the northern Sierra Nevada foothills, California: University of California, Davis, Ph.D. dissertation, 415 p., plate 1, scale 1:24,000. Tertiary stratigraphy from: Lindgren, Waldemar, 1900 (see reference 12); Lindgren, Waldemar, and Turner, H.W., 1895 (see reference 1); and Yeend, 1974 (see reference 20).

Yeend, W.E., 1974, Gold bearing gravel of the ancestral Yuba River, Sierra Nevada, California: U.S. Geological Survey Professional Paper 772, 44 p., page 1, scale 1:62,500. Modifications from: Hodos, Ellen F., 1983, Unpublished geologic mapping for Placer Service Corporation; Lindgren, Waldemar, 1900 (see reference 12); and Lindgren, Waldemar, and Turner, H.W., 1895 (see reference 1).

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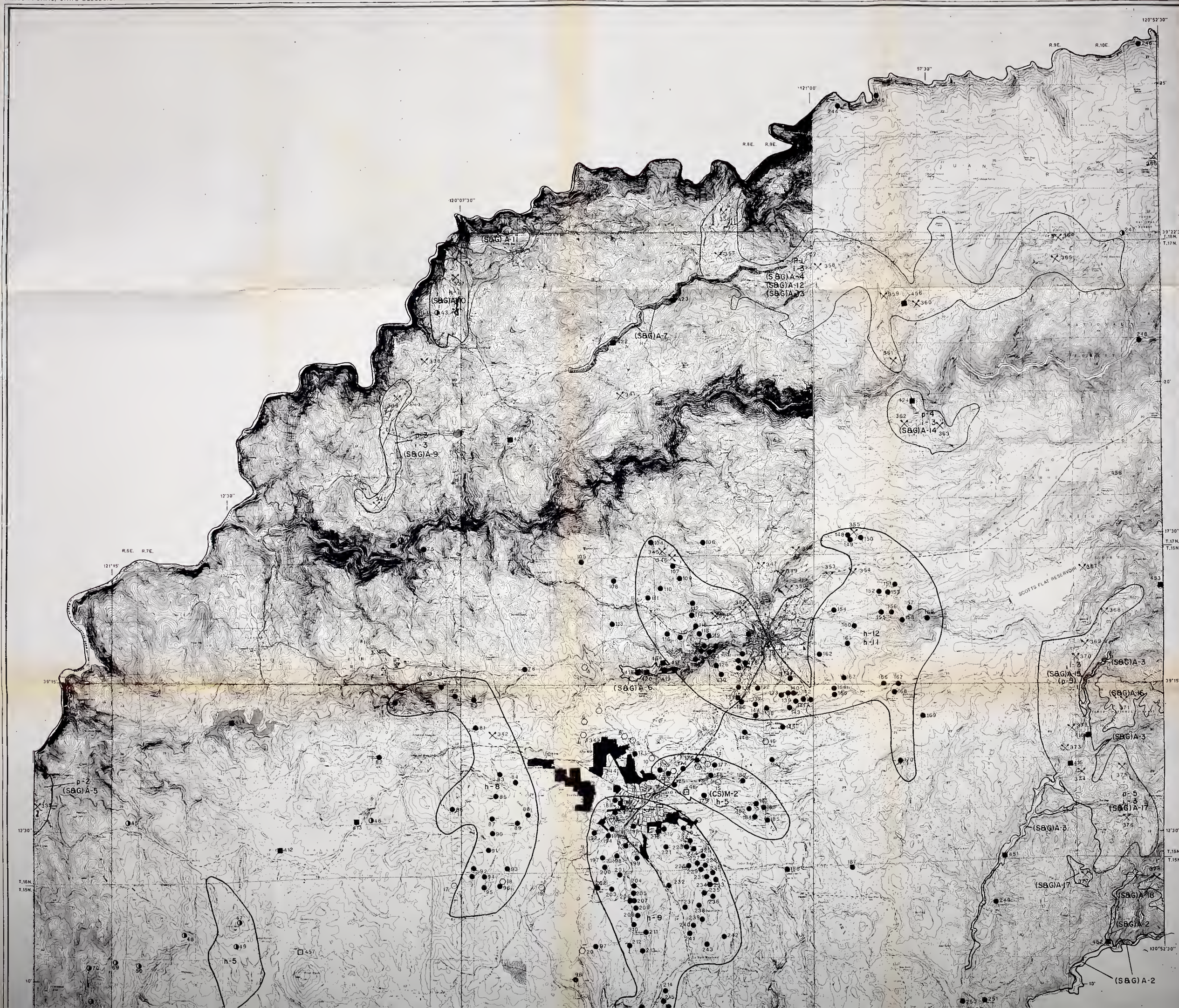
STATE OF CALIFORNIA—GEORGE DEUKMEJIAN, GOVERNOR
THE RESOURCES AGENCY—GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION—RANDALL M. WARD, DIRECTOR



Mosaicked from: Oregon House, Smartville, Camp Far West, French Corral, Challenge, Rough and Ready, Wolf, Camptonville, Nevada City, Grass Valley, Lake Combie, Pike, North Bloomfield, Chicago Park, and Colfax U.S.G.S. 7.5' Topographic Quadrangles.

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MINERAL LAND CLASSIFICATION MAP
WESTERN NEVADA COUNTY

(Areas Classified MRZ-2a and MRZ-2b for all Mineral Deposits)

by
Ralph Loyd and John Clinkenbeard

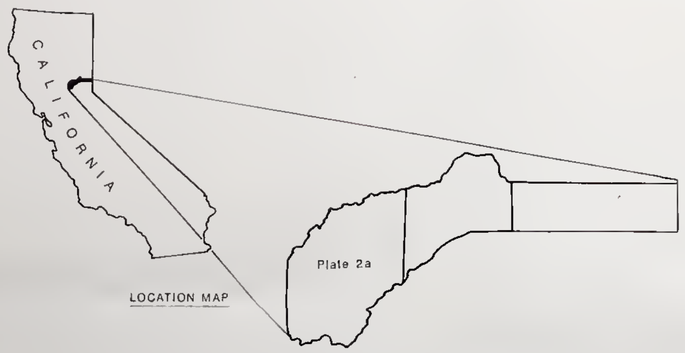
SCALE 1:48000

2 0 1 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 1 0 2 KILOMETERS

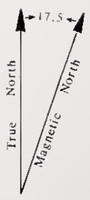
1990



LOCATION MAP

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST



MINE/PROSPECT SYMBOLS

12	●	Gold, Lode
33	◑	Copper–Zinc
373	✕	Placer Gold
4	○	Chromite
410	■	Sand and Gravel
446	□	Crushed Stone

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.) NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

EXPLANATION

p-3 i-4 A-15	Areas classified MRZ-2a or MRZ-2b (undifferentiated) with area reference numbers keyed to text decriptions (See part 1-Data Presentation section for explanation).
h	Areas classified for deposits formed by hydrothermal processes (eg. gold, silver, copper, zinc).
p	Areas classified for Placer deposits (eg. gold).
i	Areas classified for industrial mineral deposits (eg. barite, clay, silica).
(S&G)A	Areas classified for sand and gravel resources of alluvial origin.
(CS)M	Areas classified for crushed stone resources consisting of metamorphic rock.

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THE RESOURCES AGENCY–GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR

EXPLANATION

(S&G)A-16 h-2	Areas classified MRZ-2a or MRZ-2b (undifferentiated) with area reference numbers keyed to text descriptions (See part 1-Data Presentation section for explanation).
h	Areas classified for deposits formed by hydrothermal processes (eg. gold, silver, copper and zinc).
p	Areas classified for Placer deposits (eg. gold).
i	Area classified for industrial minerals (eg. barite, clay, silica).
(S&G)A	Areas classified for sand and gravel resources of alluvial origin.

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MINERAL LAND CLASSIFICATION MAP

CENTRAL NEVADA COUNTY

(Areas Classified MRZ-2a and MRZ-2b for all Mineral Deposits)

by
Ralph Loyd and John Clinkenbeard

SCALE 1:48000

2 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

1990

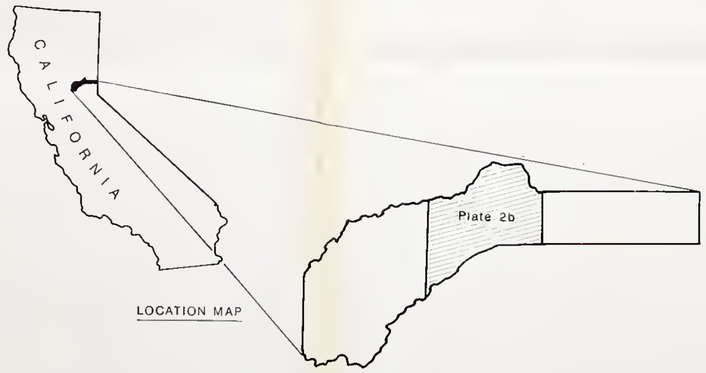
MINE/PROSPECT SYMBOLS

100	●	Gold,Lode
334	■	Molybdenum
41	○	Chromite
393	✕	Placer Gold
1	[A]	Asbestos
2	[B]	Barite
427	■	Sand and Gravel
459	□	Crushed Stone

(Numbers adjecent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

LOCATION MAP



PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

James F. Davis
STATE GEOLOGIST

Mosaicked from: Alleghany, Washington, Dutch Flat, Sierra City, Graniteville, Blue Canyon, Heypress Valley, English Mtn., and Cisco Grove U.S.G.S. 7.5 Topographic Quadrangles.

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THE RESOURCES AGENCY-GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONVERSATION-RANDALL M. WARD, DIRECTOR

Mosaicked from: Soda Springs, Webber Peak, Independence Lake, Norden, Hobart Mills, Truckee, Boca, and Martis Peak U.S.G.S. 7.5' topographic quadrangles.

MINERAL LAND CLASSIFICATION MAP
EASTERN NEVADA COUNTY
(Areas classified MRZ-2a and MRZ-2b for all Mineral Deposits)

by
Ralph Loyd and John Clinkenbeard

SCALE 1:48000

1990

EXPLANATION

h-3	Areas classified MRZ-2a or MRZ-2b (undifferentiated) with area reference numbers keyed to text descriptions (See part II - Data Presentation section for explanation).
(h)	Areas classified for deposits formed by hydrothermal processes (eg. gold).
(S&G) G	Areas classified for sand and gravel resources of glacial origin.
(CS) V	Areas classified for crushed stone resources consisting of volcanic rocks.

MINE/PROSPECT SYMBOLS

434 ■ Sand and Gravel

467 □ Crushed Stone

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

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PLATE 3a

STATE OF CALIFORNIA-GEORGE DEUKMEJIAN, GOVERNOR
THE RESOURCES AGENCY-GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION-RANDALL M. WARD, DIRECTOR

ISION OF MINES AND GEOLOGY
MES F. DAVIS, STATE GEOLOGIST

MINERAL RESOURCE ZONE CATEGORIES

MRZ-1	Areas where available geologic information indicates there is little likelihood for the presence of significant mineral resources.
MRZ-2a	Areas underlain by mineral deposits where geologic data indicate that significant measured or indicated resources are present.
MRZ-2b	Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present.
MRZ-3a	Areas containing known mineral occurrences of undetermined mineral resource significance.
MRZ-3b	Areas containing inferred mineral occurrences of undetermined mineral resource significance.
MRZ-4	Areas of no known mineral occurrences where geologic information does not rule out either the presence or absence of significant mineral resources.

Mosaicked from: Oregon House, Smartville, Camp Far West, French Corral, Challenge, Rough and Ready, Wolf, Camptonville, Nevada City, Grass Valley, Lake Combie, Pike, North Bloomfield, Chicago Park, and Colfax U.S.G.S. 7.5' Topographic Quadrangles.

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MINERAL LAND CLASSIFICATION MAP
WESTERN NEVADA COUNTY

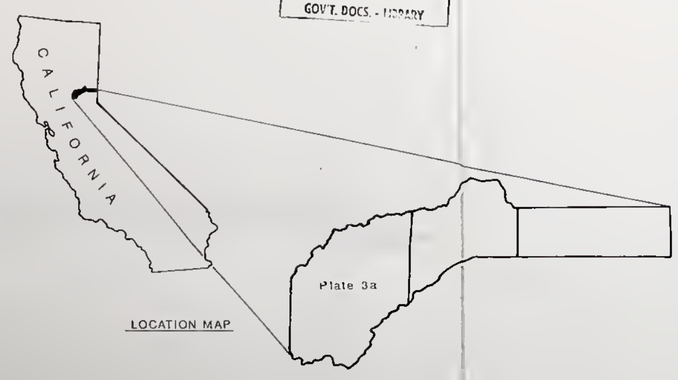
(Hydrothermal Deposits)

by
Ralph Loyd

SCALE 1:48000

2 0 2 MILES
2000 0 2000 4000 6000 8000 10000 12000 14000 FEET
2 0 2 KILOMETERS

1990



LOCATION MAP

MINE/PROSPECT SYMBOLS

100 ●	Gold, Lode
49 ◑	Copper-Zinc

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

TN24
C3
A33
no.164
Plate 9

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PLATE 3b

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STATE OF CALIFORNIA-GEORGE DEUKMEJIAN, GOVERNOR
THE RESOURCES AGENCY-GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION-RANDALL M. WARD, DIRECTOR

MINERAL RESOURCE ZONE CATEGORIES

MRZ-1	Areas where available geologic information indicates there is little likelihood for the presence of significant mineral resources.
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MINERAL LAND CLASSIFICATION MAP

CENTRAL NEVADA COUNTY

(Hydrothermal Deposits)

by
Ralph Loyd

SCALE 1:48000

2 1 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 1 0 2 KILOMETERS

1990

MRZ-4

(h-15) MRZ-2b

(h-14) MRZ-2b

(h-13) MRZ-2b

(h-16) MRZ-2b

(h-3) MRZ-2a

(h-23) MRZ-3a

(h-21) MRZ-3a

(h-22) MRZ-3b

MRZ-4

MRZ-4

MINE/PROSPECT SYMBOLS

282 ● Gold, Lode

334 ■ Molybdenum

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

LOCATION MAP

CALIFORNIA

Plate 3b

17.5

True North

Magnetic North

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

Mosaicked from: Alleghany, Washington, Dutch Flat, Sierra City, Graniteville, Blue Canyon, Haypress Valley, English Mtn., and Cisco Grove U.S.G.S. 7.5' Topographic Quadrangles.

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Plate 10

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DEPARTMENT OF CONVERSATION–RANDALL M. WARD, DIRECTOR

Mosaicked from: Soda Springs, Webber Peak, Independence Lake, Norden, Hobart Mills, Truckee, Boca, and Martis Peak U.S.G.S. 7.5' topographic quadrangles.

MINERAL LAND CLASSIFICATION MAP
EASTERN NEVADA COUNTY
(Hydrothermal Deposits)

by
Ralph Loyd

SCALE 1:48000

2 1 0 2 MILES
2000 0 2000 4000 6000 8000 10000 12000 14000 FEET
2 0 2 KILOMETERS

1990

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

MINERAL RESOURCE ZONE CATEGORIES

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A33
no 164
Plate 11

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DEPARTMENT OF CONSERVATION-RANDALL M. WARD, DIRECTOR

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Mosaicked from: Oregon House, Smartville, Camp Far West, French Corral, Challenge, Rough and Ready, Wolf, Camptonville, Nevada City, Grass Valley, Lake Combie, Pike, North Bloomfield, Chicago Park, and Colfax U.S.G.S. 7.5' topographic Quadrangles.

MINERAL LAND CLASSIFICATION MAP
WESTERN NEVADA COUNTY

(Placer Deposits)

by
Ralph Loyd

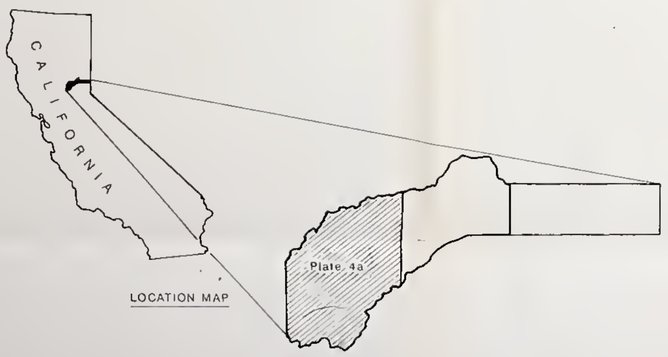
SCALE 1:48000

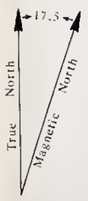
2 0 1 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

1990





PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

MINERAL RESOURCE ZONE CATEGORIES

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MINE/PROSPECT SYMBOLS

373 Placer Gold

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

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Plate 12

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THE RESOURCES AGENCY–GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR

MINERAL RESOURCE ZONE CATEGORIES

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MINERAL LAND CLASSIFICATION MAP
CENTRAL NEVADA COUNTY
(Placer Deposits)

by
Ralph Loyd

SCALE 1:48000

2 0 1 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

1990

MRZ-1

MRZ-2b (p-9)

MRZ-3a (p-8)

MRZ-2b (p-8)

MRZ-3b (p-19)

MRZ-3b (p-21)

MRZ-4

MRZ-3a (p-14)

MRZ-3a (p-17)

MRZ-2b (p-7)

MRZ-3a (p-15)

MRZ-3a (p-16)

LAKE SPAULDING

T A H O E

N A T I O N A L

F O R E S T

CALIFORNIA

LOCATION MAP

Plate 4b

MINE/PROSPECT SYMBOLS

390 Placer Gold

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

17.5° True North / Magnetic North

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

James F. Davis
STATE GEOLOGIST

Mosaicked from: Alleghany, Washington, Dutch Flat, Sierra City, Graniteville, Blue Canyon, Haypress Valley, English Mtn., and Cisco Grove U.S.G.S. 7.5'Topographic Quadrangles.

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Plate 13

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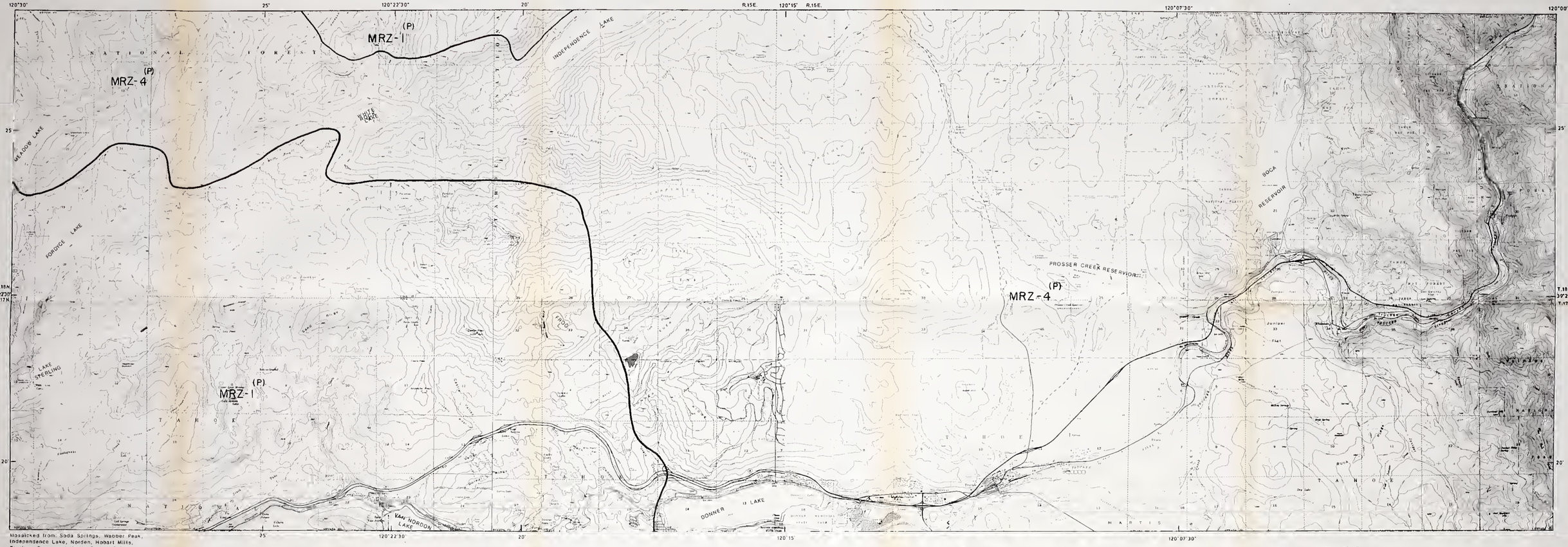
THE RESOURCES AGENCY-GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONVERSATION-RANDALL M. WARD, DIRECTOR



Mosaicked from: Soda Springs, Webber Peak, Independence Lake, Norden, Hobart Mills, Truckee, Boca, and Martis Peak U.S.G.S. 7.5' topographic quadrangles.

MINERAL LAND CLASSIFICATION MAP
EASTERN NEVADA COUNTY
(Placer Deposits)

by
Ralph Loyd

SCALE 1:48000

1990

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MINERAL RESOURCE ZONE CATEGORIES

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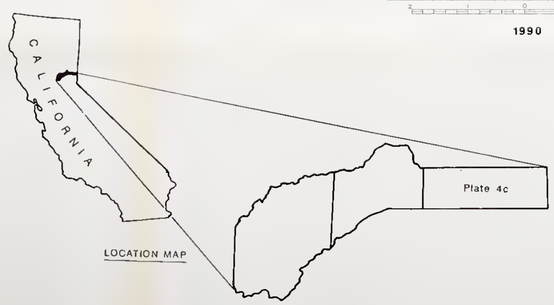

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

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no 164
Plate 14

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DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR

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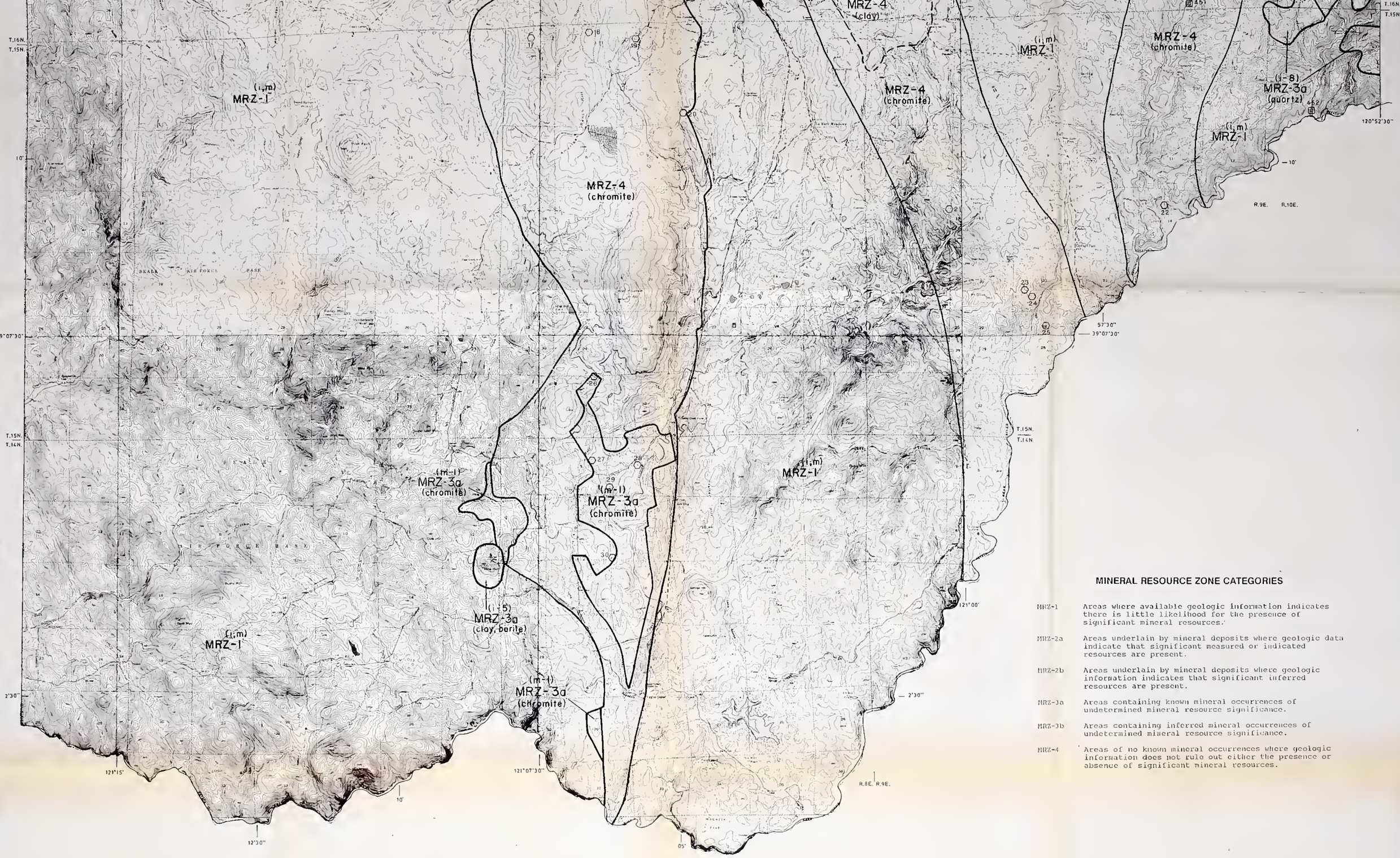

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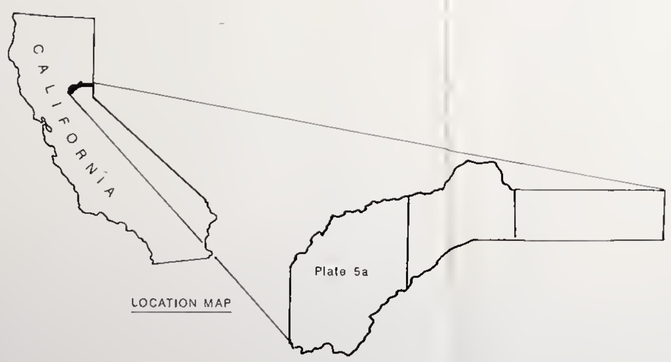


MINERAL LAND CLASSIFICATION MAP
WESTERN NEVADA COUNTY

(Industrial Minerals and Deposits formed by Magmatic Segregation)

by
Ralph Loyd

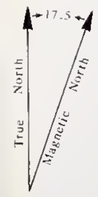
SCALE 1:48000

2 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

1990



PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

MINE/PROSPECT SYMBOLS

⬡4	Chromite
⊡456	Quartz

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

TN24
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A33
no.164
Plate 15

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DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR

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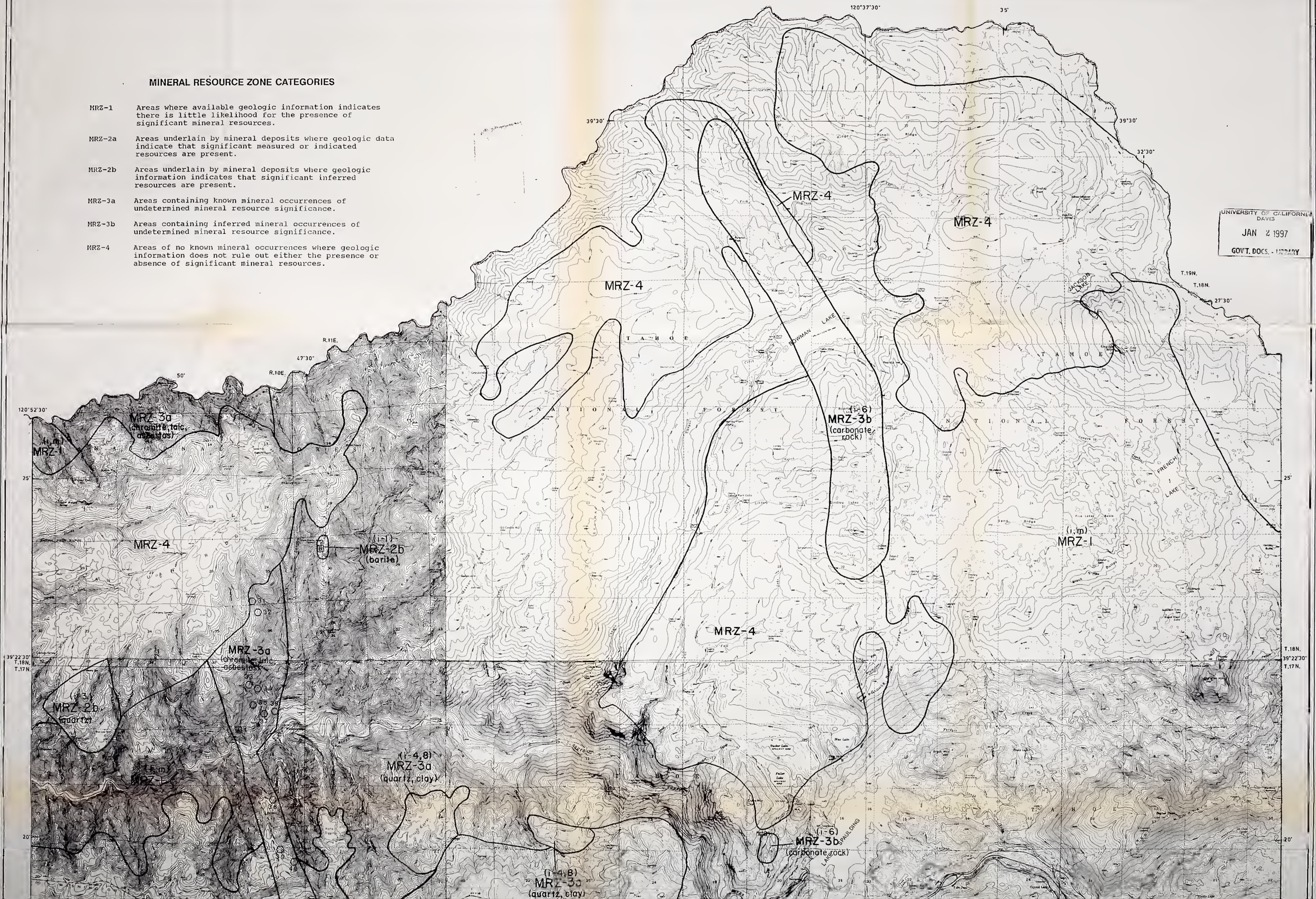

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MINERAL LAND CLASSIFICATION MAP
CENTRAL NEVADA COUNTY
(Industrial Minerals and Deposits formed by Magmatic Segregation)

by

Ralph Loyd

SCALE 1:48000

2 1 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

1990

MRZ-4

(i-3) MRZ-2b (quartz)

MRZ-2b (barite)

MRZ-3a (chromite, talc, asbestos)

(i-4,8) MRZ-3a (quartz, clay)

(i-4,8) MRZ-3a (clay, quartz)

(i-6) MRZ-3b (carbonate rock)

(i-2) MRZ-2b (barite)

LOCATION MAP

CALIFORNIA

Plate 5b

MINE/PROSPECT SYMBOLS

41 ⬡ Chromite

1 [A] Asbestos

2 [B] Barite

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

17.5°

True North

Magnetic North

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

Mosaicked from: Alleghany, Washington, Dutch Flat, Sierra City, Graniteville, Blue Canyon, Haypress Valley, English Mtn., and Cisco Grove U.S.G.S. 7.5' Topographic Quadrangles.

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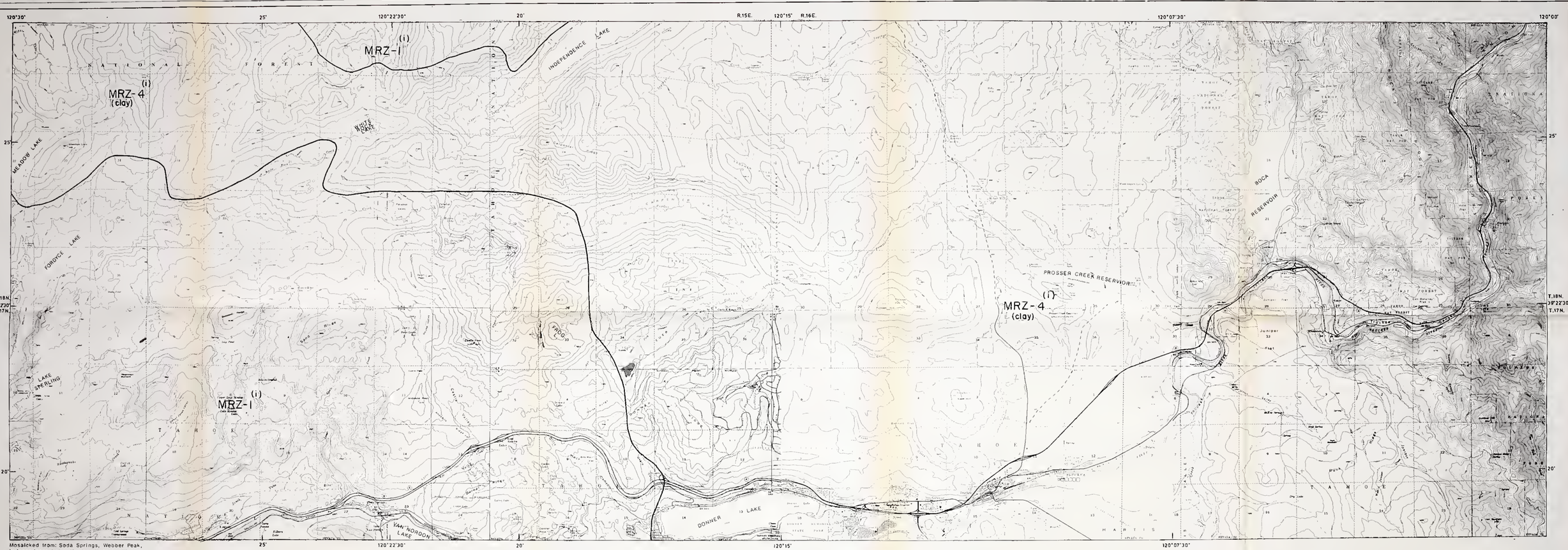
DEPARTMENT OF CONVERSATION–RANDALL M. WARO, DIRECTOR



MINERAL LAND CLASSIFICATION MAP
EASTERN NEVADA COUNTY
(Industrial Minerals and Deposits formed by Magmatic Segregation)

by
Ralph Loyd

SCALE 1:48000
2 1 0 2 MILES
2000 0 2000 4000 6000 8000 10000 12000 14000 FEET
2 0 2 KILOMETERS

1990

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MINERAL RESOURCE ZONE CATEGORIES

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DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR

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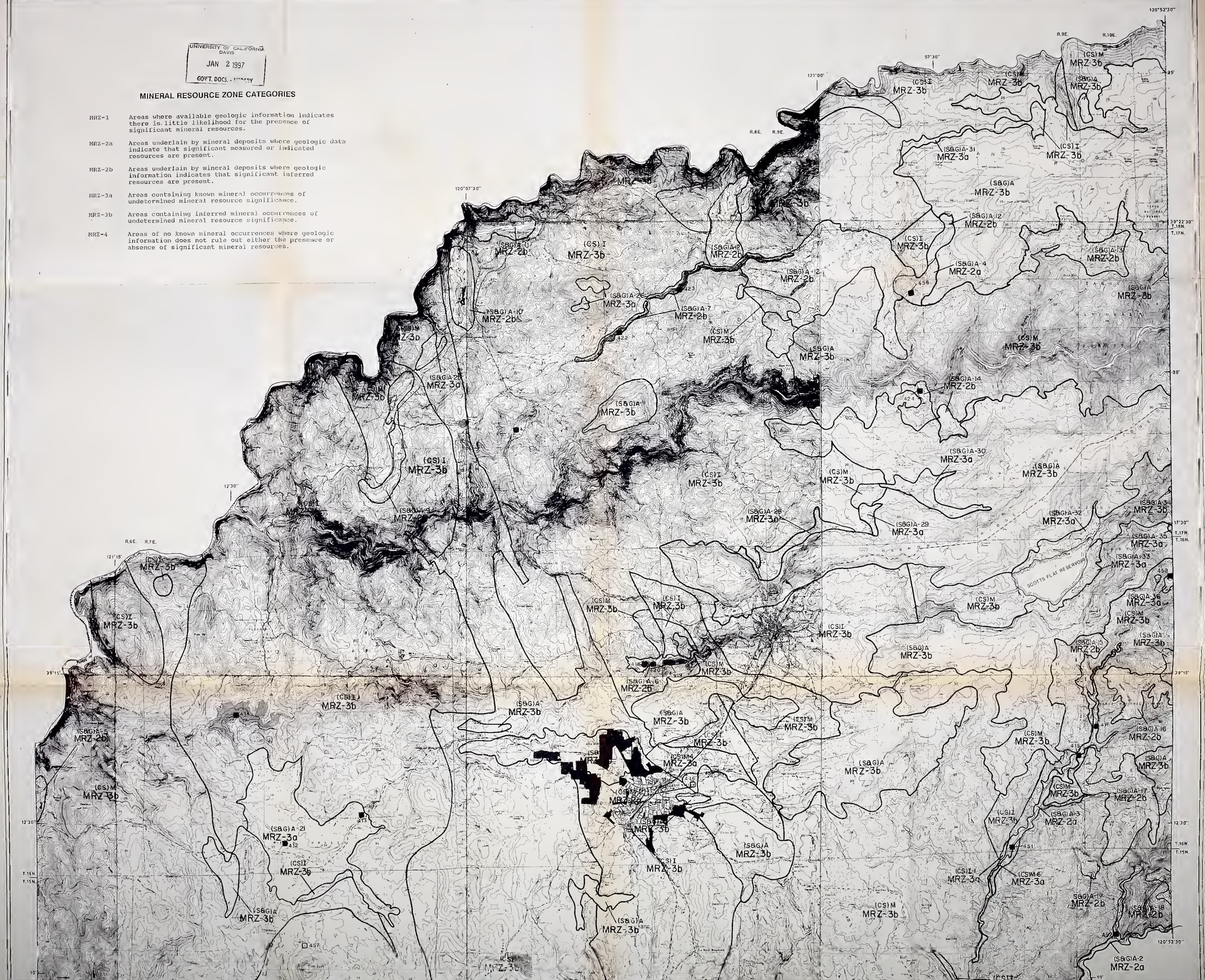

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MINERAL LAND CLASSIFICATION MAP

WESTERN NEVADA COUNTY

(Construction Aggregate Deposits)

by

John Clinkenbeard

SCALE 1:48000

2 0 2 MILES

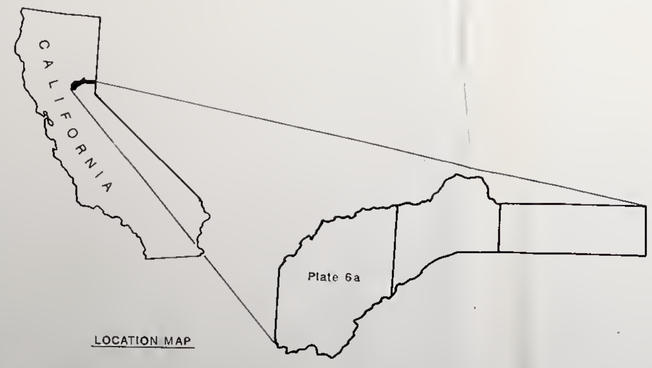
2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 1 0 2 KILOMETERS

1990

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

James F. Davis
STATE GEOLOGIST



LOCATION MAP

CONSTRUCTION AGGREGATE RESOURCE IDENTIFIERS

Crushed stone		Sand and gravel	
(CS)I	Plutonic igneous rocks	(S&G)G	Glacial deposits
(CS)V	Volcanic igneous rocks	(S&G)A	Alluvial deposits
(CS)M	Metemorphic rocks		

MINE/PROSPECT SYMBOLS

- ■ 411 Sand and Gravel
- □ 446 Crushed Stone

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

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C3
A33
no.164
Plate 18

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DMG SR 164
PLATE 6b

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STATE OF CALIFORNIA–GEORGE DEUKMEJIAN, GOVERNOR
THE RESOURCES AGENCY–GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR

CONSTRUCTION AGGREGATE RESOURCE IDENTIFIERS

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(CS)M	Metemorphic rocks		

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MINERAL LAND CLASSIFICATION MAP

CENTRAL NEVADA COUNTY

(Construction Aggregate Deposits)

by
John Clinkenbeard

SCALE 1:48000

2 1 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 1 0 2 KILOMETERS

1990

17.5

North True North Magnetic North

LOCATION MAP

MINERAL RESOURCE ZONE CATEGORIES

MRZ-1	Areas where available geologic information indicates there is little likelihood for the presence of significant mineral resources.
MRZ-2a	Areas underlain by mineral deposits where geologic data indicate that significant measured or indicated resources are present.
MRZ-2b	Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present.
MRZ-3a	Areas containing known mineral occurrences of undetermined mineral resource significance.
MRZ-3b	Areas containing inferred mineral occurrences of undetermined mineral resource significance.
MRZ-4	Areas of no known mineral occurrences where geologic information does not rule out either the presence or absence of significant mineral resources.

MINE/PROSPECT SYMBOLS

■427 Sand and Gravel

□459 Crushed Stone

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

James F. Davis
STATE GEOLOGIST

Mosaicked from: Alleghany, Washington, Dutch Flat, Sierra City, Graniteville, Blue Canyon, Haypress Valley, English Mtn., and Cisco Grove U.S.G.S. 7.5 Topographic Quadrangles.

TN24
C3
A33
no.164
Plate 19

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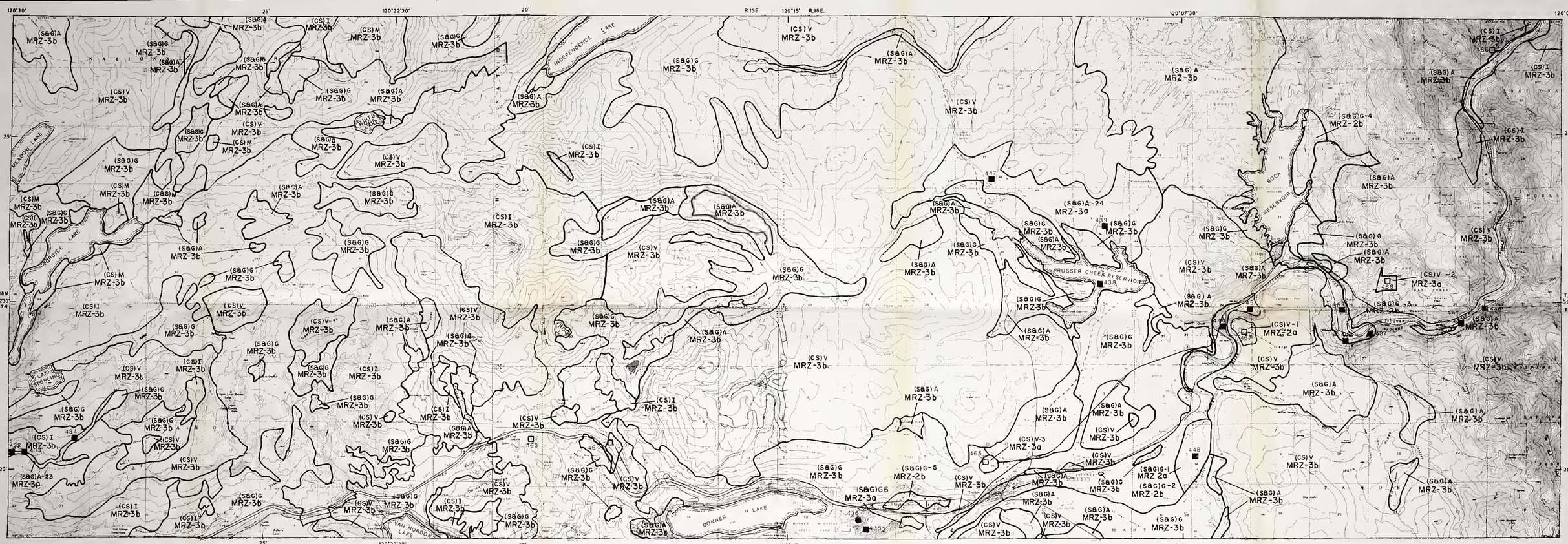
THE RESOURCES AGENCY–GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR



Mosaicked from: Soda Springs, Webber Peak, Independence Lake, Norden, Hobart Mills, Truckee, Boca, and Martis Peak U.S.G.S. 7.5' topographic quadrangles.

MINERAL LAND CLASSIFICATION MAP

EASTERN NEVADA COUNTY

(Construction Aggregate Deposits)

by

John Clinkenbeard

SCALE 1:48000

2 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

1990

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James F. Davis

STATE GEOLOGIST

17.5°

True North

Magnetic North

CONSTRUCTION AGGREGATE RESOURCE IDENTIFIERS

Crushed stone	Sand and gravel
(CS)I Plutonic igneous rocks	(S&G)G Glacial deposits
(CS)V Volcanic igneous rocks	(S&G)A Alluvial deposits
(CS)M Metamorphic rocks	

MINE/PROSPECT SYMBOLS

434 ■ Sand and Gravel

467 □ Crushed Stone

(Numbers adjacent to symbols index mine/prospect references in the text and listing in Appendix A.)

NOTE: Active mines, inactive mines, and prospects are not distinguished on maps.

MINERAL RESOURCE ZONE CATEGORIES

MRZ-1	Areas where available geologic information indicates there is little likelihood for the presence of significant mineral resources.
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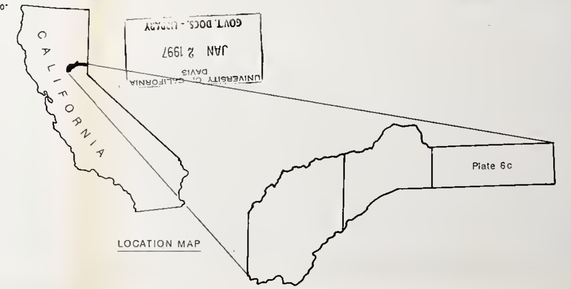
MRZ-2b	Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present.
MRZ-3a	Areas containing known mineral occurrences of undetermined mineral resource significance.
MRZ-3b	Areas containing inferred mineral occurrences of undetermined mineral resource significance.
MRZ-4	Areas of no known mineral occurrences where geologic information does not rule out either the presence or absence of significant mineral resources.



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ARA-1

ARA-9

ARA-14

ARA-12

ARA-13

ARA-22

HANSEN BROTHERS ENTERPRISES

ARA-12

ARA-21

ARA-16

ARA-20a

ARA-20

R. J. MILES COMPANY

ARA-23

R.9E. R.10E.

BEALE AIR FORCE BASE

ARA-17

ARA-18

JOE. CHEVREAUX COMPANY

ARA-18

ARA-19

R.8E. R.9E.

T.16N. T.15N.

T.15N. T.14N.

12°30"

10'

39°07'30"

57'30"

121°15'

121°07'30"

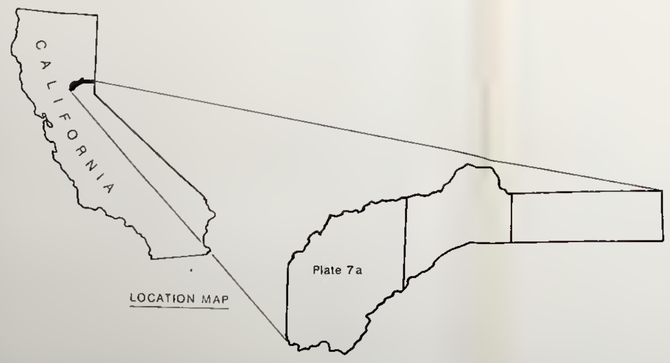
121°00'

05'

Mosaicked from: Oregon House, Smartsville, Camp Far West, French Corral, Challenge, Rough and Ready, Wolf, Camptonville, Nevada City, Grass Valley, Lake Combie, Pike, North Bloomfield, Chicago Park, and Colfax U.S.G.S. 7.5' Topographic Quadrangles.

AGGREGATE RESOURCE AREAS WESTERN NEVADA COUNTY

(Areas classified MRZ-2a or MRZ-2b for aggregate and deemed to be available for mining)



LOCATION MAP

by
John Clinkenbeard

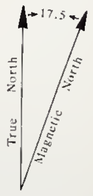
SCALE 1:48000

2 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 0 2 KILOMETERS

1990



PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

STATE GEOLOGIST

EXPLANATION

Property permitted for aggregate mining.

ARA — An Aggregate Resource Area (ARA) is an area that has been classified as MRZ-2a or MRZ-2b for construction aggregate by the State Geologist and is deemed to be available for mining based upon criteria for compatibility provided by the State Mining and Geology Board.

(IS) — IMMEDIATELY SIGNIFICANT - All lands within Aggregate Resource Areas which are currently permitted for aggregate mining.

(HS) — HIGHLY SIGNIFICANT - Aggregate Resource Areas that contain in excess of 10 times threshold value * of material (based upon criteria established by the State Mining and Geology Board), or that are adjacent to permitted property. **

(S) — SIGNIFICANT - All remaining Aggregate Resource Areas containing less than 10 times threshold value of material (based upon criteria established by the State Mining and Geology Board). **

* Threshold value at the time of this report is approximately 9.7 million dollars or approximately 1.94 million tons of aggregate in the study area.

** If conditions warrant, an Aggregate Resource Area category can be changed from HS to S or from S to HS. These conditions may include, but are not limited to, local scarcity of commodity, proximity to operating aggregate mine, and distance from market areas.

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DEPARTMENT OF CONSERVATION-RANDALL M.WARD, DIRECTOR

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120°37'30"
35'
39°30'
32'30"
27'30"
T.19N.
T.18N.
R.11E.
47'30"
R.10E.
50'
120°52'30"
25'
39°22'30"
T.18N.
T.17N.
20'
R.12E.
R.13E.
32'30"
120°30'
T A H O E
N A T I O N A L F O R E S T
BOWMAN LAKE
JACKSON LAKE
FRENCH LAKE
SPAULDING LAKE
Ridge
Creek
Lake
Meadow
Pass
Mtn.
ARA-26
S

AGGREGATE RESOURCE AREAS CENTRAL NEVADA COUNTY

(Areas classified MRZ-2a or MRZ-2b for aggregate and deemed to be available for mining)

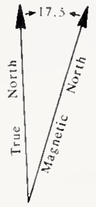
by
John Clinkenbeard

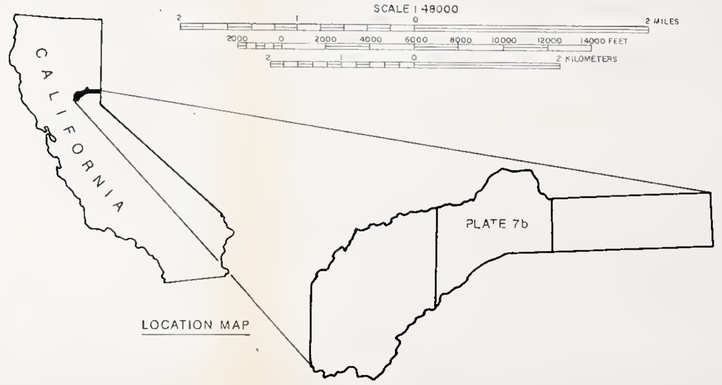
SCALE 1:48000

2 1 0 2 MILES

2000 0 2000 4000 6000 8000 10000 12000 14000 FEET

2 1 0 2 KILOMETERS





LOCATION MAP

EXPLANATION

Property permitted for aggregate mining.

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PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

James F. Davis
STATE GEOLOGIST

Mosaicked from: Alleghany, Washington, Dutch Flat, Sierra City, Granite ville, Blue Canyon; Haypress Valley, English Mtn, and Cisco Grove U.S.G.S. 7.5' Topographic Quadrangles.

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THE RESOURCES AGENCY–GORDON K. VAN VLECK, SECRETARY FOR RESOURCES
DEPARTMENT OF CONSERVATION–RANDALL M. WARD, DIRECTOR

Mosaicked from: Soda Springs, Webber Peak, Independence Lake, Norden, Hobart Mills, Truckee, Boca, and Martis Peak U.S.G.S. 7.5' topographic quadrangles.

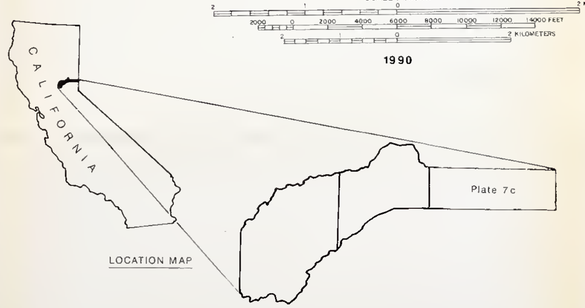
AGGREGATE RESOURCES AREAS EASTERN NEVADA COUNTY

(Areas classified MRZ-2a or MRZ-2b for aggregate and deemed to be available for mining)

by
John Clinkenbeard

SCALE 1:48000

1990



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STATE GEOLOGIST

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